Five-Year Review Report

Pursuant to CERCLA

Second Five-Year Review Report
Auto Ion Chemicals Inc. Superfund Site
Kalamazoo, Kalamazoo County, Michigan

Prepared by:

U.S. Environmental Protection Agency
Region 5
Chicago, Illinois

In conjunction with:

Michigan Department of Environmental Quality
Lansing, Michigan

Approved by:

Richard C Karl

9-22-06

Richard C. Karl, Director
Superfund Division

Date

[This page intentionally left blank.]

Table of Contents

Tables

Attachments

EXECUTIVE SUMMARY

The Auto Ion Chemicals Inc. Superfund (Auto Ion) site is a 1.5-acre parcel of land located in Kalamazoo, Michigan. The site is in a light industrial area and is bordered by the Kalamazoo River along its southern edge. The property was originally used as an electrical generating station by the City of Kalamazoo from sometime during the 1940s until 1956. From 1964 to 1973, Auto Ion Chemicals operated a treatment facility for electroplating waste at the site. Wastewater was discharged to the sanitary sewer, and sludges were disposed of in an on-site lagoon. Poor storage and waste handling practices resulted in numerous spills onto surface soil and within the basement of the facility building, and several unpermtted discharges to the Kalamazoo River and city sewers were documented. In 1973, the Auto Ion facility ceased operations after its license to transport, store, and treat liquid industrial waste was not renewed by the State. Contaminants of concern at the site are heavy metals associated with electroplating waste, such as cadmium, chromium, nickel and zinc, and two volatile organic compounds.

In 1982, USEPA proposed the Auto Ion site for inclusion on the National Priorities List (NPL), and in 1983 the Auto Ion site was officially placed on the NPL and designated a Superfund site.

In 1985, USEPA oversaw a removal action at the site. Surface debris, sludges, and containerized wastes were removed from the site and a fence was erected. The City of Kalamazoo razed the on-site building in 1986.

The 1989 Record of Decision (ROD) addressed the first operable unit at the site which was the contaminated soil that was the source of groundwater contamination. The remedy selected for the first operable unit included excavation of soil on portions of the site and off-site disposal. Treatment of the excavated soil, if necessary, was done prior to transporting it off-site. During this remedial action, which was completed in 1993, over 24,000 tons of soil were removed from the site.

The second operable unit, groundwater contamination, was addressed in a ROD completed in 1994. The selected remedy required institutional controls to limit groundwater use and the development of a groundwater monitoring plan using alternate concentration limits and a contingency plan for determining whether any additional actions needed to be taken.

The remedy for the Auto Ion site is protective in the short term. The potential human health exposure risks due to ingestion of, inhalation of, or dermal contact with soil have been addressed, and the groundwater is being monitored to ensure the remedy remains protective.

To ensure that the remedy is protective in the long term, institutional controls to limit future use of groundwater at the site must be implemented. There are currently no deed or other type of restrictions on the property.

This is the second five-year review report for Auto Ion. This review covers both operable units at the site.

[This page intentionally left blank.]

Five-Year Review Summary Form (page 1 of 2)

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Auto Ion Chemicals Inc.		
EPA ID *(from WasteLAN)*: MID980794382		
Region: 5	**State:** MI	**City/County:** Kalamazoo/Kalamazoo County

SITE STATUS	
NPL status: X Final ☐ Deleted ☐ Other (specify)	
Remediation status (choose all that apply): ☐ Under Construction ☐ Operating X Complete	
Multiple operable units (OUs)? X YES ☐ NO	**Construction completion date:** 9/23/1994
Has site been put into reuse? ☐ YES X NO	

REVIEW STATUS	
Lead agency: X EPA ☐ State ☐ Tribe ☐ Other Federal Agency	
Author name: Mary Tierney	
Author title: Remedial Project Manager	**Author affiliation:** USEPA
Review period: 3/27/2006 to 9/28/2006	
Date of site inspection: 6/28/2006	
Type of review: X Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion	
Review number: ☐ 1 (first) X 2 (second) ☐ 3 (third) ☐ Other (specify)	
Triggering action: ☐ Actual RA On-site Construction at OU #___ ☐ Actual RA Start at OU# ☐ Construction Completion X Previous Five-Year Review Report ☐ Other (specify)	
Triggering action date *(from WasteLAN)*: 9/28/2001	
Due date *(five years after triggering action date)*: 9/28/2006	

Five-Year Review Summary Form (page 2 of 2)

Issues:

1. Lack of institutional controls to prevent use of groundwater beneath the site for drinking.
2. Lack of an assessment of the overall effectiveness of the planned institutional controls and lack of a monitoring and compliance plan for institutional controls.

Recommendations and Follow-up Actions:

1. Implement institutional controls to restrict use of groundwater.
2. Complete an Institutional Control Study to assess effectiveness of planned institutional controls and evaluate the need for any additional controls, and develop an Institutional Control Plan to establish a monitoring and compliance program for institutional controls.

Protectiveness Statements:

Short-Term Protectiveness

Based on the available data, the remedy for the Auto Ion site is protective in the short term. The potential exposure risks due to ingestion of, inhalation of, and dermal contact with soil have been addressed, and groundwater is being monitored. Although institutional controls to restrict groundwater use are not in place, no drinking well installation or other development has taken place at the site.

Long-Term Protectiveness

Long-term protectiveness of human health and the environment will be achieved when institutional controls are implemented.

Other Comments:

AUTO ION CHEMICALS INC. SUPERFUND SITE
KALAMAZOO COUNTY, MICHIGAN
FIVE-YEAR REVIEW REPORT

I. INTRODUCTION

Authority and Purpose

The purpose of a five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and identify recommendations to address them.

USEPA is preparing this five-year review report pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *[i]f the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

USEPA interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *[i]f a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

USEPA, Region 5, conducted the five-year review of the remedy being implemented at the Auto Ion Chemicals Inc. Superfund site in Kalamazoo County, Michigan. The review was conducted by the USEPA Remedial Project Manager, Mary Tierney, with assistance from Mary Schafer, Michigan Department of Environmental Quality (MDEQ), from March 2006 through September 2006. This report documents the results of the review. The final review report will be placed in the USEPA site files and at the local repositories for the Auto Ion site at the Kalamazoo Public Library, Kalamazoo, Michigan. This is the second five-year review for the Auto Ion Superfund site.

The triggering action for this statutory review is the last five-year review completed on September 28, 2001. This five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

II. SITE CHRONOLOGY

Table 1 - Chronology of Site Events

EVENT	*DATE*
City of Kalamazoo operated a coal-burning electrical generating station at the site	1940s to 1956
Property purchased by Consumers Power Company	1956
Property purchased by Auto Ion Chemicals Inc.	1964
Numerous violations for improper waste handling and improper discharge of waste noted at the Auto Ion facility	1964 to 1973
President of Auto Ion arrested for transport of liquid industrial wastes without the license required by Michigan Act 136	July 1970
State of Michigan did not renew Auto Ion's license to transport liquid hazardous wastes and withdrew its certification as a waste treatment facility; facility ceased operations	1973
Property reverted to State due to failure by Auto Ion Chemicals to pay taxes	1981
Proposal to NPL	December 30, 1982
Final NPL Listing	September 8, 1983
Removal action addressed uncontained wastes in basement of facility, on-site storage tanks, abandoned drums, and liquid waste in a concrete lagoon	December 1984 to March 1985
Administrative Order on Consent (AOC) for RI/FS	June 18, 1986
Demolition of on-site buildings	September 1986
Field work for remedial investigation/feasibility study (RI/FS)	October 1987 to March 1988
RI/FS completed (OU1 and OU2)	September 27, 1989
Record of Decision signed (OU1)	September 27, 1989
Consent Decree for RD/RA entered (OU1) (first group of Settling Defendants)	March 26, 1991
Consent Decree for RD/RA entered (OU1) (second group of Settling Defendants)	November 18, 1991
Remedial Design completed (OU1)	March 16, 1993
Start of Remedial Action (OU1)	April 19, 1993

EVENT	*DATE*
Explanation of Significant Difference to establish alternative treatment standards for excavated soils signed by USEPA	April 23, 1993
Excavation of soils outside of the area of the building foundation	May 1993 to July 1993
Excavation within building basement area	August 1993 to September 1993
Construction Completion (OU1)	August 1994
Preliminary Close-Out Report (OU1)	September 1994
Feasibility Study completed (OU2)	September 23, 1994
Record of Decision signed (OU2)	September 23, 1994
Non-concurrence letter from State of Michigan regarding remedy selected for OU2	September 30, 1994
Consent Decree for RD/RA becomes effective (OU2)	March 12, 1997
Baseline groundwater sampling conducted	November 1997 to December 1999
Operation and Maintenance (O&M) begins	2000
First five-year review completed	September 28, 2001

III. BACKGROUND

Physical Characteristics

The Auto Ion Chemicals Inc. Superfund (Auto Ion) site is located at 74 Mills Street in a commercial/industrial district of northeast Kalamazoo, Michigan (see Attachment 1, Figure 1). The site occupies approximately 1.5 acres of vacant, fenced land adjacent to the Kalamazoo River (see Attachment 1, Figure 2). Prior to remediation, a building which originally housed a power generating station and later the electroplating waste treatment facility was centrally located on the site. An on-site lagoon used to store sludges was located on the west side of the site. The site is bordered to the north by O'Neill Street, to the east by Mills Street, to the south by the Kalamazoo River, and to the west a parcel of land occupied by Universal Litho, a division of Merchants Publishing Company. The closest residential area is approximately 500 feet to the north.

Except near the bank of the Kalamazoo River, the topography of the site is flat. Grass covers the site, and a row of mature trees lines the river's edge. The length of the property boundary along the riverfront is approximately 250 feet. Part of site lies within the 100-year floodplain for the Kalamazoo River.

A facility called Production Painting used to be located on the parcel to the west of the site, and an auto impound was formerly located to the north of the site. A Conrail railroad shipping yard occupies the property across Mills Street to the east and northeast. Both the Conrail property and the former Production Painting facility are listed on Michigan's Public Act 307 list of sites of environmental contamination[1]. The stretch of river bordering the Auto Ion site is also a portion of the Kalamazoo River/Allied Paper/Portage Creek Superfund site. Directly across the river from the site is a municipal golf course which was built on a former municipal dumping area. An athletic field and riverfront park are across the river to the southeast of the site. A river walk runs adjacent to the Kalamazoo River along the opposite bank. (See Attachment 1, Figure 3, for features in the area of the site.)

The river, which flows northwest, is the major drainage-way for the City of Kalamazoo and surrounding areas. In the area of the Auto Ion site, the river is approximately five feet deep and 110 feet wide. The average flow rate is approximately 850 cubic feet per second. At this rate, it takes approximately three to four minutes for the river to traverse the 250-foot frontage of the Auto Ion site. On average, five gallons of groundwater discharge into the river per each complete passage of the river. The average dilution ratio of surface water to groundwater is approximately 70,000 to 1. The Kalamazoo River is a gaining stream and empties into Lake Michigan approximately 80 miles downstream at Saugatuck, Michigan.

Because the site is adjacent to a river, the geology in the area of the Auto Ion site is very non-homogeneous. Groundwater is encountered about eight feet below ground level (bgl). This shallow aquifer extends to approximately 25 feet bgl and is made up of sand and gravel. A semi-confining layer of clayey silt separates the shallow and intermediate aquifer in the parts of the site farther away from the river. Boring logs for monitoring wells near the river, however, do not show the presence of a continuous confining layer between the aquifers. Because of the lack of a continuous confining layer between the shallow and intermediate depths, the two are considered to be hydraulically connected. The intermediate part of the aquifer extends to approximately 100 feet bgl. Neither the shallow nor intermediate aquifers are used as a source of drinking water. Bedrock that begins at 100 feet bgl is the strata from which the City municipal wells draw water. No confining layer is known to be present between the intermediate and deep aquifer.

The aquifers at the site are in close hydraulic communication with the Kalamazoo River. Because of this, groundwater flow direction at the site is unpredictable and varies according to the flow in the river and is consequently subject to substantial short-term variation. The relatively high hydraulic conductivity of the aquifer at the Auto Ion site permits rapid response to precipitation events and to changes in stage height of the Kalamazoo River. When the Kalamazoo River is acting as a discharge area, groundwater beneath the site flows to the southwest towards the river. During times when the river level is higher, however, a reversal of the groundwater flow is seen. Because it is known that river water regularly recharges the groundwater beneath the site, it is possible that contaminants from the river are being transported into the site aquifer. However, this is not thought to be a significant source of groundwater contamination at the site.

Land and Resource Use

According to the 2000 census, the population of the City of Kalamazoo is over 77,000. The City is 25 square miles in area and is centrally located in the lower part of the State. The immediate area around the Auto Ion site is primarily light industrial, and the closest residential area is 500 feet north of the site along East Michigan Avenue. Because of the railroad yard to the east and northeast of the site, there is no through street connecting the site to the residential area.

[1] Michigan Public Act 307 has been replaced by Part 201 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). For consistency, in this five-year review report the Michigan list of sites of environmental contamination will be referred to as the "Act 307" list.

The zoning category for the Auto Ion property is "M-2", which refers to a General Manufacturing District. In contrast to M-1 zones, Limited Manufacturing Districts, which are primarily intended to accommodate low-impact manufacturing, M-2 zones are intended to accommodate low-, moderate- and high-impact industrial uses and activities and to prevent encroachment by residential and other uses that would eventually lead to land use conflicts. Unless a zoning variance is granted, no residential developments will be allowed on the property. According to the Amended and Restated Brownfield Plan (May 2005) prepared by the City of Kalamazoo, the Auto Ion site meets the eligibility requirements for a brownfield property. (See Attachment 2 for an excerpt from the plan.) At this time, there are no plans to develop the site and it is anticipated that the site will remain vacant.

The City of Kalamazoo's drinking water is supplied by a number of municipal well fields which draw groundwater from the deep bedrock aquifer. The two closest active well fields are about 3,000 feet to the southeast and 1.5 miles to the northeast of the Auto Ion site. None of the city municipal wells draw water from the contaminated aquifer at the Auto Ion site.

The Kalamazoo River, which flows along the southern boundary of the site, is designated as a "natural river" under authority of Michigan's Natural Rivers Act (Part 305 PA 451, 1994). In the City of Kalamazoo and other communities along the river corridor, the river is used for recreational purposes such as fishing and canoeing but not as a source of drinking water. There are a number of permitted discharges to the river from area industry. The Michigan Department of Community Health (MDCH) has issued "no consumption" and "recommended limits" fish advisories for over 80 miles of the Kalamazoo River, including the portion near Auto Ion (see Attachment 3). The part of the river that flows past the Auto Ion site is designated as the Morrow Dam to Allegan Dam section. For this section, the no consumption advisory applies to carp, suckers, channel catfish, and certain sizes of largemouth and smallmouth bass, and a restricted consumption advisory is in effect for all other species. Although there are a number of fish advisory warnings for the river, recreational fishing is allowed. The advisories serve to inform and educate residents about the health risks associated with eating fish from the river.

The basis for the fish consumption advisories is polychlorinated biphenyl (PCB) contamination in the river. The PCB-contaminated sediments are part of the Kalamazoo River/Allied Paper/Portage Creek Superfund site and are not associated with Auto Ion. The part of the river that constitutes the Kalamazoo River Superfund site is also classified as a Michigan Act 307 site. Historical discharges from paper manufacturing facilities and other types of industry are the main source of the PCB contamination. (See Attachment 1, Figure 4, for a map of the Kalamazoo River/Allied Paper/Portage Creek site, and Figures 5 and 6 for potential historical discharge locations.) Sources of wastewater discharges upgradient of the Auto Ion site include two former waste disposal ponds for a paper mill (opposite side (west bank) of the river), a series of sewage disposal ponds (same side (east bank) of the river), a municipal landfill, and two wastewater treatment sewage disposal areas (see Attachment 1, Figure 7).

Despite the contamination in the river, a wide variety of wildlife and plant communities can be found in the Kalamazoo River corridor (see Attachment 4). Among the many reptilian, amphibian and mammalian species that live along the river, several endangered, threatened and sensitive species have been identified. A great blue heron rookery is located approximately fifty miles downstream of the Auto Ion site near Lake Allegan. Since 1990, the Allegan State Game Area near Lake Allegan has been a bald eagle nesting site. No endangered or threatened species, however, are known to use the Auto Ion site.

History of Contamination

The Auto Ion property was originally used as an electrical generating station by the City of Kalamazoo from sometime during the 1940s until 1956, when Consumers Power purchased the plant. Shortly thereafter, the plant was closed and dismantled. In 1963, Consumers Power entered into a land contract with James Rooney, the owner of Auto Ion Chemicals Inc. From 1964 to 1973, the Auto Ion Chemical Company operated as a treatment, storage, and disposal (TSD) facility for electroplating wastes containing cyanide and heavy metals. Treatment operations included cyanide destruction, precipitation of heavy metals, and disposal of metal sludges in an on-site lagoon.

During its time of operation, structural features on the property included the main building, numerous fuel and storage tanks, an open-air lagoon, and a blockhouse on the river. Liquid waste was stored in the open-air lagoon. In addition, five process storage tanks were located in the building's basement. The plant was designed to precipitate the heavy metals from chromium and cyanide waste. The sludge, after being dewatered in the lagoon, was then supposed to be transported to a disposal site, and the supernatant that was created in the course of treating the cyanide waste was to be discharged into the sanitary sewer system. Inadequate waste treatment and storage, however, led to a multitude of spills and illegal discharges into the Kalamazoo River and into the storm and sanitary sewer systems.

Auto Ion ceased active water management operations in 1973 when the facility's license to operate as a TSD facility was not renewed by the Water Resources Commission due to numerous violations. Contained and uncontained liquid waste was left in the building and on the grounds at that time. When the company ceased operations in 1973, approximately an inch of sludge was present in the basement of the Auto Ion building. Samples of sludge wastes collected in 1982 showed the presence of cyanide, hexavalent chromium, total chromium, cadmium, copper, nickel, lead, and zinc. According to MDEQ, by the time the remedial actions took place in the early 1990s waste in the basement of the building was significantly greater than one inch in depth.

The State of Michigan obtained title to the site in 1981 as a result of Auto Ion's failure to pay taxes.

Initial Response

In 1985, USEPA oversaw a surface removal action that was conducted by several potentially responsible parties. The removal included treating liquid wastes and sludge from the on-site lagoon and the facility's basement. Treated liquid wastes were subsequently discharged into the municipal sewer system. After being treated, the sludge excavated from the lagoon was transported to an approved landfill. On-site storage tanks were cleaned and removed along with drums and contaminated debris.

The removal action was followed in 1986 by the demolition of on-site structures that were in disrepair. Pursuant to an agreement with the State of Michigan, the City of Kalamazoo razed the structures. Demolition debris was placed into the structure's basement area.

Basis for Taking Action

To assess the risks posed by the site after the 1985 removal action was complete, a number of "indicator chemicals" were selected. These chemicals were a subset of the compounds detected at the site and were chosen to serve as the best indicators of potential risk based on relative toxicity, levels detected at the site, and general policy. The Superfund Public Health Evaluation Manual (October 1986) was one of the main references used to generate the initial list of chemicals. The ten inorganic compounds included in the list of indicator chemicals were arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, silver, and cyanide. The eight organic compounds used as indicator chemicals included bis(2-ethylhexyl)phthalate; three chlorinated compounds (1,2-dichloroethane (1,2-DCA), vinyl chloride, and trichloroethene (TCE)); and four polyaromatic hydrocarbons (PAHs) (benzo(a)pyrene, dibenz(a,h)anthracene, benzo(a)anthracene and chrysene).

The exposure pathways developed in the risk assessment for the site included dermal contact with soil, inhalation of airborne dust, ingestion of soil, and ingestion of groundwater. Incidental ingestion of soil was considered to be a significant exposure pathway for children and adults.

The risk assessment for the site stated that groundwater was not a likely exposure pathway because it was not used as a source of drinking water on or adjacent to the site and because the area was served by municipal water. It also stated that "[b]ased on the nature of the site, its location in a 100-year floodplain, and its history" it was unlikely that a drinking water well would be installed on the site. Although USEPA thought it was unlikely that the groundwater exposure pathway would be completed, site risks both with and without the groundwater pathway were evaluated.

The risk assessment also stated that surface water was not expected to be a significant human exposure pathway for the site. The reasons given were that the Kalamazoo River was not used as a source of drinking water and there were a number of fish consumption advisories in place due to the river being a 307 site. This pathway was not evaluated in the risk assessment; however, a sediment toxicity study to determine the potential impact of the site on the Kalamazoo River was conducted.

For the conditions at the site at the time the risk assessment was completed, the noncarcinogenic risks for an adult were less than the threshold value of 1.0. For children, the result for noncarcinogenic risks for the realistic worst case scenario was 2.21. When the potential for drinking groundwater at the site were taken into account, the risk for the worst case scenario went up to 33.5 for children and 15.4 for adults. This means that for children, over 90% of the noncarcinogenic risk was based on drinking groundwater from the site. Similarly, for adults, over 98% of the noncarcinogenic risk was due to drinking groundwater. These results took into account the additive effects of exposure to all of the compounds selected as chemical indicators. The results for the noncarcinogenic risk calculations are shown below.

Noncarcinogenic Risks (children)

Pathway	Most probable case	Realistic worst case
Groundwater	24.9	31.3
Soil	1.8	2.2
Total	26.7	33.5
Risk due to groundwater ingestion	93%	93%

Noncarcinogenic Risks (adults)

Pathway	Most probable case	Realistic worst case
Groundwater	12.0	15.1
Soil	0.2	0.3
Total	12.2	15.4
Risk due to groundwater ingestion	98%	98%

The risk assessment completed for the Auto Ion site also calculated the excess lifetime cancer risks for adults that were exposed to chemicals at the site over the course of their lives. The results for the most probable and worst cases are shown below. As with the noncarcinogenic risks, the carcinogenic risk due to ingestion of groundwater accounted for over 95% of the total risk.

Carcinogenic Risks (adults only)

Pathway	Most probable case	Realistic worst case
Groundwater	1.68×10^{-3}	3.05×10^{-3}
Soil	7.6×10^{-5}	1.06×10^{-4}
Total	1.76×10^{-3}	3.16×10^{-3}
Risk due to groundwater ingestion	95%	97%

The results of the evaluation of potential increases in carcinogenic risk due to the site showed that without taking into consideration the possibility that groundwater at the site would be used for drinking water, the realistic worst case was within the acceptable range provided in the National Contingency Plan (NCP)[2]. If it was assumed that groundwater from the site would be ingested, the risk for the realistic worst case scenario was 3.16×10^{-3}.

To assess the ecological impact of the site, sediment and surface water samples were collected in 1988, and an investigation of the Kalamazoo River in the vicinity of the Auto Ion site was conducted in October 1992. The 1992 investigation, referred to as the Sediment Toxicity Evaluation, was conducted by the University of Michigan and consultants representing the Settling Defendants and was overseen by USEPA and MDEQ. The investigation identified the areas of sediment deposition in the river, assessed the quantity and quality of species living in the river sediments, and evaluated the impact of sediments on species near the Auto Ion site. The study concluded that no adverse effect could be demonstrated on living species as a result of the discharge of contaminated groundwater from the site to the Kalamazoo River.

The results of the analyses of surface water and sediment samples collected in 1988, were consistent with the 1992 results. In 1988, 24 surface water and sediment samples – four samples along each of six transects – were collected from the river. Three of the six transects were near the Auto Ion site, one was approximately 150 feet upstream, one was ½ mile downstream, and one was 1 mile downstream. The surface water samples collected in the 1988 study showed the surface water near the Auto Ion site contained several heavy metals, including chromium, cadmium, copper, lead, silver, and zinc, that were at levels greater than those in upstream samples.

[2] The acceptable risk range provided in the NCP for excess lifetime cancer risk (ELCR) is 1×10^{-4} to 1×10^{-6} (one in 10,000 to one in a million).

Results from the 1988 study showed that sediments from each of the six transects contained organic contaminants and heavy metals. Two of the sediment samples – one from downstream and one from adjacent to the Auto Ion site – contained levels of chromium above background. The sediment collected near the former waste water discharge line from the site contained six times the amount of chromium (113 mg/kg) as background (19 mg/kg). Lead was elevated in a sample near Auto Ion and in a downstream sample. The amount of lead (208 mg/kg) in the sediment sample near the southeast edge of the site was downstream of a storm water runoff drain and was over ten times higher than the highest background concentration (18 mg/kg). Cadmium and silver were only detected in the downstream samples, and the highest level of zinc was detected in a downstream sample. Mercury at a concentration of 2.9 mg/kg was detected in a sediment sample near the bank opposite the Auto Ion site and across from a surface water discharge pipe. The highest values for mercury were in two sediment samples near the Auto Ion site and one sample collected a mile downstream. The sediment samples from the downstream locations contained the greatest variety of organic compounds. PCBs, the contaminants of concern in the Kalamazoo River Superfund site, were detected in sediment samples collected at downstream locations and near the Auto Ion site. For a summary of the inorganic contaminants found in sediments during the 1988 sampling, see Attachment 5.

In the 1992 study, seven sediment samples were collected from locations upstream, downstream and adjacent to the site. Twenty samples for identification of biota present in the river were also collected. While the main purpose of the 1988 sampling was to define the contamination in the river due to historical spills and discharges from the Auto Ion site, the purpose of the 1992 investigation was to evaluate the potential impact of site contaminants on indigenous fauna due to discharge of groundwater from the Auto Ion site. As part of the study, river sediments were collected and analyzed and tests were done on the sediments to better define their biological and physical characteristics. In addition, toxicity evaluations were carried out using two species of aquatic organisms.

The results of the 1992 study showed that the macroinvertebrate community indigenous to the Kalamazoo River in the area of the Auto Ion site was quite diverse, abundant and typical for the type of habitat. According to two ecological testing indices, based on surface water samples collected from upstream, downstream and near the site, the surface water with the highest quality was adjacent to the site. For the tests that involved two aquatic organisms, *Hyalella* and *Chironomous*, in all except for one sample the study showed no statistically significant effect on the rate of survival for either species. At one location adjacent to the site, reductions in the weight of both species were found to be statistically significant.

IV. REMEDIAL ACTIONS

Remedy Selection

The remediation of the Auto Ion sites was separated into two discrete actions or operable units – OU1 and OU2. The Record of Decision (ROD) for the first operable unit (OU1) at the Auto Ion site was signed by USEPA on September 27, 1989, and the ROD for the second operable unit (OU2) was signed by USEPA on September 23, 1994. OU1 addressed the principal threat at the site by removing and treating the contaminated soil that was acting as the source of groundwater contamination. OU2 addressed groundwater contamination.

The remedial alternative selected for OU1 was for "selected vadose zone excavation/stabilization/ disposal" and consisted of the following:

- Excavation and off-site treatment, via stabilization, of approximately 7,200 cubic yards of contaminated soil;
- Disposal of the treated soils in an appropriate off-site facility; and
- Replacement of the excavated soil with clean fill.

This source control operable unit called for the excavation, treatment and disposal of the most highly contaminated surface and subsurface soils. Because site data showed that the higher levels of contaminants were for the most part above the groundwater table, the OU1 ROD specified that excavation would proceed to the water table (approximately 10 feet below grade) in areas where soils contained contaminants above cleanup levels. The excavation areas would not extend all the way to the water table in those areas where confirmational samples showed that cleanup levels were met at shallower depths. In April 1993, an Explanation of Significant Difference (ESD) to the OU1 ROD was signed by USEPA to document a treatability variance for the Resource Conservation and Recovery Act (RCRA) F006 waste on the site. F006 is the hazardous waste code (40 Code of Federal Regulations (CFR) Part 261) for wastes from electroplating operations.

In 1994, USEPA signed a ROD for the second operable unit at the site to address groundwater contamination. The remedy for OU2 included:

- Institutional controls to limit groundwater use;
- Establishment of Alternate Concentration Limits (ACLs) for groundwater;
- Monitoring of groundwater; and
- Development of a Remedial Action Plan that defines the steps to be taken to determine if an ACL exceedence may adversely impact the Kalamazoo River.

The selected alternative allowed for the development of ACLs based on the first eight rounds of baseline groundwater monitoring samples collected from November 1997 through December 1999. The ACLs act as action levels and an exceedence of an ACL prompts an evaluation of the impact the concentration may have on the Kalamazoo River. The specific steps of the evaluation process are provided in the 1998 Remedial Action Plan (RAP) for the site. As required in the OU2 ROD, the RAP developed a plan for pre-determined response actions to address ACL exceedances.

The plan for addressing ACLs exceedences presented in the RAP follows a step-wise approach that includes verifying the analytical results and conducting confirmational sampling prior to proceeding with further action. In the event of an exceedence of an ACL, the first step after verifying the validity of the data is to confirm the exceedence in the next round of sampling. If an exceedence is confirmed, the concentration is statistically compared to background concentrations to see if the ACL exceedence was due to changes in the background or upgradient conditions. If it is verified that the exceedence is not due to background concentrations, the concentration is compared to federal surface water quality criteria (SWQC) taking into account with the mixing zone at the site. The procedures for this comparison to federal SWQC are based on those outlined in the USEPA National Pollutant Discharge Elimination System (NPDES) Permit Writer's Manual (December 1996).

If the results of this step show that surface water criteria are exceeded, the frequency of the sampling is increased to monthly for the three months. The data collected are then statistically analyzed to determine their significance. The next step is to evaluate the impact of the ACL exceedence on the Kalamazoo River. If it is demonstrated that the Kalamazoo River is being adversely impacted, remedial action alternatives is considered. Examples of potential additional actions listed in the OU2 ROD are: confirmational sampling, increased sampling frequency, determination of impact to the Kalamazoo River through surface water, sediment and biota sampling, or installation of a groundwater extraction system.

Attachment 6 includes a copy of the RAP decision flow chart that shows the steps taken in the case of an ACL exceedence. Examples of the calculations carried out to determine significance compared to background and comparison to federal SWQC criteria are shown in Attachment 7.

As stated in the Statement of Work attached to the remedial design/remedial action (RD/RA) Consent Decree, groundwater sampling will continue until the performance standard is achieved. The performance standard requires that for a period of eight consecutive sampling events, groundwater concentrations be at or below Michigan Act 245, Rule 57 (and Rule 82 as applicable), groundwater/surface water interface (GSI) values or USEPA maximum contaminant limits (MCLs), whichever was more stringent at the time groundwater sampling began.

Remedy Implementation

Following issuance of the ROD for OU1, USEPA and a number of Settling Defendants entered into Consent Decrees in 1991 to prepare a remedial design and conduct a remedial action.

Prior to initiating the OU1 cleanup, approximately 30 soil samples from off-site locations were collected in November 1991 to establish background concentrations. A subsequent round of on-site soil sampling, referred to as Phase I confirmational sampling, was completed in August 1992 to better define the extent of the soils requiring excavation. For Phase I sampling, approximately 30 on-site samples were collected and analyzed. Because Phase I adequately defined the extent of contaminated soil, Phase II sampling was not necessary. The objective of the pre-remediation soil sampling referred to as Phase III was to characterize waste. In this phase, eight additional on-site soil samples were collected. The information from Phase III work helped to estimate the volume and location of soils that would be considered listed RCRA hazardous waste.

During the OU1 remedial action, approximately 11,850 tons of soil and debris were characterized as non-hazardous, and 10,377 tons of soil and 2,016 tons of soil and debris were characterized as hazardous (F006) (see Attachment 8). In all, 24,243 tons of material were excavated and disposed off-site. Soils containing hazardous substances were disposed of at RCRA Subtitle C facilities. F006 soils that did not meet LDRs were treated prior to land disposal using stabilization/fixation technologies. Non-hazardous soils (i.e., those soils that did not contain F006 constituents exceeding site cleanup criteria and did not exceed cleanup levels for other contaminants of concern) were disposed of at an off-site RCRA Subtitle D facility.

The extent of vadose zone soils removed was based on site-specific cleanup standards established at the carcinogenic risk level of $1x10^{-6}$ or the average background level, whichever was higher (see Attachment 9). If soil samples from the bottom vadose zone exceeded cleanup levels, excavation continued up to the water table and no additional confirmational samples were collected. The following cleanup levels for vadose zone soil were developed for Auto Ion based on pre-design soil sampling:

Compound	Cleanup Level (mg/kg)	Basis
Arsenic	14.1	background levels
Cadmium	2.45	background levels
Chromium	84,700	risk calculations
Lead	119	risk calculations
Nickel	149	risk calculations
PAHs	13.8	risk calculations

Because the size of the basement in the on-site building had been underestimated, the remedial action for OU1 was divided into two phases – excavation of soil outside of the basement area and excavation of soils within the basement area. Phase I, which addressed the soil outside of the basement area, started in May 1993 and was completed in July 1993. During Phase I, an effluent pipe uncovered during excavation activities was tested to ensure that the concrete was not F006 waste. Approximately 5,300 gallons of contaminated water from inside the pipe was pumped out and disposed of. The concrete pipe itself was left in place. A total of 64 confirmational soil samples from areas outside of the basement were analyzed to ensure cleanup levels were achieved (see Attachment 10). Confirmational samples were not required for the excavation areas that extended to 10 feet bgl.

Phase II excavation was carried out from August through October 1993. As part of the cleanup, concrete core samples of the basement walls around the foundation of the basement floor were collected. None of the wall samples contained metals at concentrations above the cleanup criteria; therefore, the walls were used as backfill material in part of the excavation near the southeast corner of the site. The concrete from the basement floor was removed and disposed of as F006 waste. All remaining soil and debris within the basement were excavated and disposed of as non-hazardous waste. A total of 42 confirmational samples from the basement excavation were analyzed to ensure cleanup levels were achieved (see Attachment 10). Confirmational samples were not required for the excavation areas that extended to the basement floor.

During the design phase, estimates for the areal extent of contaminated soil in three excavation depths (0 to 3 feet bgl; 3 to 7 feet bgl; and 7 to 10 feet bgl) were developed based on investigative and pre-design soil samples. The estimate for the amount of soil between 0 to 3 feet needing excavation from was very close to the actual amount of soil removed. For the soil in the 3 to 7 foot range, the actual soil volume excavated was greater than planned. This was in part due to soil in the southeastern-most corner of the site that had not been identified during pre-design sampling as requiring removal. Soil in the 7 to 10 foot range required additional unplanned excavation along the western part of the site. A second area of contamination in the 7 to 10 foot range identified during the remedial action that had not been anticipated was contaminated soil beneath the basement floor.

The entire site is 1.5 acres in area. Approximately one acre of the soil, almost two-thirds of the site, was excavated down to 3 feet below grade. The area excavated from 3 feet below grade to either the floor of the basement (within the basement area) or to ten feet below grade (outside of the basement) was approximately 0.8 acre, or more than one-half of the site. These estimates are based on Figures 2-6 through 2-10 in the OU1 Remedial Action Report (March 1994) (see Attachment 11).

A Consent Decree for the OU2 RD/RA was entered on March 12, 1997. The OU2 remedial action included institutional controls (discussed in the following section), developing groundwater ACLs, devising the site Remedial Action Plan (discussed in "Remedy Selection" section of this report), installing monitoring wells, and conducting long-term monitoring. The methodology used to develop the preliminary ACLs was consistent with RCRA guidance. Preliminary ACLs were developed in June 2000. In 2004, the statistical methodology for calculating the ACLs was changed, and final numbers for the ACLs were established in December 2004. Attachment 12 contains documentation for how the revised ACLs were calculated. The final ACLs are included in Attachment 13. Ten monitoring wells, two upgradient of the site and eight on the site, were installed as part of the OU2 remedial action work. Groundwater is monitored semi-annually.

Institutional Controls

The OU2 ROD and the RD/RA Consent Decree require institutional controls to restrict use of groundwater beneath the site. Institutional controls are necessary for any areas which do not allow for unlimited use or unrestricted exposure (UU/UE). This may include areas both on and off the source property. The type of institutional control referred to in the OU2 ROD were deed restrictions which would assure that groundwater would not be used as a source of drinking water in the future. Section IX of the Consent Decree states that the Settling Defendants would use best efforts to cause deed restrictions to be implemented. Due to tax default, the property is now owned by the State of Michigan. The Settling Defendants and State have been in frequent communication over the years, but to date the institutional controls are not in place. Ensuring that these controls are implemented will be one of the follow-up actions of this five-year review report.

Although lacking the benefits of a site-specific institutional control, there are several factors that help to minimize the possibility that the aquifer beneath the site will be used for drinking water. The Kalamazoo County drinking water well permitting process requires a review of potential sources of contamination for a new well. Auto Ion is both a Superfund site and a Michigan Act 307 site and would be identified as a potential source of contamination during the permitting process. In addition, there are two other Act 307 sites and the Kalamazoo River/Allied Paper/Portage Creek site, a Superfund and Act 307 site, nearby. Due to these local sources of contamination, it is unlikely that a permit for installation of a new drinking well would ever be granted. Additionally, Michigan Act 399 prohibits the development of drinking water wells within the 100-year floodplain of any rivers of the State. Part of the Auto Ion site is in the 100-year floodplain of the Kalamazoo River (see Attachment 14). This further decreases the chance that a well would be installed on the property. Zoning for the site is general manufacturing. Unless the City of Kalamazoo approved a zoning variance for the property, this should deter residential development of the site. Verifying that no zoning variances are granted will be part of the IC monitoring plan that will be developed.

Despite these protections, site-specific use restrictions running with the land and required by the OU2 ROD must be implemented to ensure long-term protectiveness. USEPA will require an IC Study be prepared that includes the following components:

- a current survey of the property comprising the Auto Ion Site;
- an evaluation of which portion(s) of the Auto Ion property must be subject to groundwater use restrictions in order to ensure long-term protectiveness of the remedy;

- a legal description and survey of that portion of the Auto Ion property where groundwater use restrictions are necessary to ensure long-term protectiveness of the remedy;

- a determination regarding whether prior existing encumbrances must be addressed;

- an evaluation of whether the City of Kalamazoo has ever granted a zoning variance for the property;

- an evaluation of whether, to ensure the long-term protectiveness and the integrity of the remedy, use restrictions other than those pertaining to groundwater should be implemented on all or a portion of the Auto Ion property and/or off-site;

- a draft declaration of environmental easement and restrictive covenant, running with the land and enforceable under Michigan law, which: (1) prohibits the use of groundwater from any aquifer located at the Auto Ion property for drinking water purposes; (2) if necessary, limits or prohibits excavation activities on the property; and (3) grants MDEQ and USEPA, as a third-party beneficiary, the right to access the property to monitor and verify the effectiveness of the selected remedy and to perform any additional response actions selected pursuant to CERCLA;

- a strategy for ensuring that the restrictive covenant, when approved by USEPA, will be recorded by the current title holder to the property; and

- maps showing the areas where ICs are required and areas where ICs have been implemented.

In addition, an IC Plan will be prepared to establish a monitoring and compliance program for institutional controls. The IC Plan will also include an annual certification to USEPA that institutional controls are in place and effective. USEPA will work closely with the Settling Defendants, the City of Kalamazoo and the State of Michigan to develop the required strategy for implementing the use restrictions and ensuring their enforceability under Michigan law.

The need for restrictions pertaining to site soils will also be evaluated in the IC Study. The site-specific cleanup standards for the soil excavation were based on the carcinogenic risk level of $1x10^{-6}$ or the average background level, whichever was higher. Also, if soil samples from the bottom of the vadose zone exceeded cleanup levels, excavation continued up to the water table. Because the limits of soil excavation were not defined solely by risk, this may not allow for unlimited use and unrestricted exposure, and some type of institutional control may be appropriate. Restrictions and controls necessary to protect the integrity of the remedy will also be evaluated as part of the IC Study.

More detailed requirements regarding what will be included in the IC Study and IC Plan will be provided by USEPA.

Operation and Maintenance

Two upgradient and eight on-site monitoring wells are sampled as part of operation and maintenance (O&M) at Auto Ion (see Attachment 1, Figures 8 and 9). Until mid-2003, sampling was conducted quarterly, but the frequency was reduced to twice per year, in January and July, beginning in 2004. The locations of the eight on-site monitoring wells were based on results of vertical profile sampling conducted in 1994. The highest concentrations of chemicals seen during sampling were in the shallow aquifer near the water table (approximately 10 feet below ground level (bgl)) and in the deep aquifer slightly above the bedrock layer (approximately 100 feet bgl). At the boring in the southwest corner of the site near the river, vinyl chloride was detected at an intermediate depth of 60 feet bgl. Based on these results, three on-site well nests were installed near these areas of detected contaminants. Each of the three well nests includes a shallow well (approximately 15 feet bgl) and a deep well (approximately 85 feet bgl). At the well nest in the southwest corner of the site, two additional intermediate wells, screened at approximately 25 feet bgl and 60 feet bgl, were also installed. This is the location where vinyl chloride was detected during the vertical profiling work. All three well nests are located near the bank of the Kalamazoo River.

Until 2004, the protocol for groundwater sampling involved documenting nearly two weeks of steady-state flow towards the Kalamazoo River. Because of the variability in the groundwater flow direction at the site and the frequent flow reversals, at times it took several months of daily groundwater elevation measurements to achieve this criterion. The criterion was revised in 2004 so that sampling commences after two weeks of elevation measurements.

As part of O&M, the site fence, warning sign, and monitoring wells are inspected during each sampling event and any problems are either reported in the groundwater sampling reports or in both the reports and in a letter. The site fence and warning sign appear to be effective in deterring trespassers from entering the site and preventing damage to the site monitoring wells.

Funding and Operation

Annual costs of O&M projected in the OU2 ROD were $21,700 per year. The assumptions used to calculate this number, however, did not sufficiently capture all of the costs involved in monitoring. For example, the original cost calculations did not include costs for equipment or preparation of monitoring reports. In addition, the projected amount is in 1993 dollars and does not take into account inflation and cost increases. Given an average annual inflation rate of 2.58% between 1993 and 2005, today the equivalent amount would be approximately $30,000.

Although cost information for the initial years of O&M is not available, costs in 2004 and 2005 were significantly above the estimate in the ROD even after taking into consideration the effect of inflation. In 2004, groundwater sampling, monitoring reports, and analytical costs came to approximately $69,000. In 2005, these costs were approximately $48,000. Table 2 shows the annual costs for 2004 and 2005.

Table 2 - Annual O&M Costs

Year	Cost of Sampling and Reporting	Analytical Costs	Total
2004	$60,700	$8,200	$68,900
2005	$41,800	$6,600	$48,400

Although the increase in actual costs can be explained in part by the inaccuracy of the original estimate, several other factors have also contributed to the increases. One is the number of confirmational sampling rounds that have been conducted. Another factor is the number of days of groundwater level measurements needed during some of the sampling rounds. The repeated measurements of groundwater levels were due to a requirement in the Remedial Action Plan (discussed in the Operation and Maintenance section). Costs have also been incurred for the development of revised ACLs and for work related to investigating potential locations for supplemental upgradient monitoring well.

V. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The last five-year review report completed in 2001 for the Auto Ion site concluded that the remedy was expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through monitored attenuation, which was expected to require 50 to 60 years to achieve. The following table shows the recommendations from the 2001 review and the follow-up actions that were taken. "NS" is shown if the information was not specified.

Table 3 - Actions Taken Since Last Five-Year Review

Issue from Previous Review	Recommendation From Previous Review	Party Responsible	Milestone Date	Action Taken	Date of Action
NS	Continue O&M activities	Settling Defendants	NS	O&M has been conducted per requirements in the RAP	On-going
Modifications to methodology used to calculate preliminary ACLs required	Revise preliminary ACLs	Settling Defendants	NS	Revised methodology developed	Final ACLs established in December 2004

VI. FIVE-YEAR REVIEW PROCESS

Administrative Components

MDEQ and the Settling Defendants were notified of the initiation of the five-year review in March 2006. The preparation of the Auto Ion five-year review was led by Mary Tierney, USEPA, with assistance and review provided by Mary Schafer, MDEQ. USEPA was the lead Agency for the review. The components of the five-year review schedule include:

- Community notification
- Document review
- Data review
- Site inspection
- Report development and review

Community Involvement

A public notice was published in the Kalamazoo Gazette on April 13, 2006 to announce that USEPA was conducting a five-year review of the Auto Ion site (see Attachment 15). Interviews with residents were held on June 28, 2006. Most of the residents who were interviewed were not familiar with the Auto Ion site but did know there were PCB problems with the sediment in the Kalamazoo River and knew that a number of industries along the river had contamination problems. The manager of the printing facility adjacent to the Auto Ion site had been was aware of the history and has had no concerns about the site since cleanup actions were completed. The director of a daycare center approximately 500 feet to the northwest of the site was not aware that a Superfund site was nearby. City officials are knowledgeable about the site and are satisfied that the site has been properly addressed. They feel it is important that the site continue to be monitored to ensure the cleanup remains protective, but other contaminated sites in the area, such as the Kalamazoo River, are a more immediate concern for them at present. The Auto Ion site has been designated by the City as a brownfield property, and it is hoped that a new commercial or industrial operation will occupy the site at some point. Because the site is adjacent to the river, there may also be interest in converting the area to a small park or nature area. In general, awareness of the site is very low in the community.

Document Review

This five-year review consisted of a review of relevant documents including the RODs, investigatory reports and studies, site plans, correspondence, remedial design documents, remedial action documents, O&M records, annual evaluation reports, and monitoring data (see Attachment 16).

Data Review

Data reviewed include both statistical groundwater contamination trend tests and ACL exceedences. The trend tests were carried out using statistical software that used a 95% confidence level and were based on a non-parametric, log-normal treatment of the data. Further information about the statistical methodology and the procedures for handling non-detects and outliers can be found in Attachment 17. The trend analyses evaluate groundwater monitoring data between January 2000 and March 2006. ACL exceedences were evaluated using the process established in the Remedial Action Plan.

<u>Trend Analyses</u>

A trend analysis was conducted for eight groundwater contaminants of concern (COCs) for each of the eight on-site monitoring wells (64 cases total). The eight COCs are: arsenic, total chromium, cyanide, mercury, nickel, TCE, vinyl chloride, and zinc. The trend analyses revealed the following:

- Six cases of increasing trends of COCs;
- Ten cases of decreasing trends COCs; and
- Forty-eight instances of no change in groundwater contamination.

These results show that in 90% of the cases, there is no trend or a decreasing trend. Increasing trends accounted for the remaining 10% if the cases. Mercury was the one COC for which neither an increasing nor a decreasing trend was seen. Attachment 18 contains results for all of the analyses. The wells and contaminants for which upward and downward trends were calculated are shown below.

Downward Trends	Upward Trends
Arsenic in MW3A	Arsenic in MW4B
Arsenic in MW4A	Chromium (total) in MW5C
Nickel in MW4A	Cyanide in MW5B
Nickel in MW5A	Nickel in MW3B
Nickel in MW5C	Nickel in MW4B
Trichloroethene in MW5C	Trichloroethene in MW5D
Vinyl chloride in MW5A	
Vinyl chloride in MW5C	
Zinc in MW4B	
Zinc in MW5C	

The two increasing trends of most significance are those for cyanide in MW-5B (25 ft bgl) and total chromium in MW-5C (60 feet bgl). Cyanide was not detected in MW-5B until 2001. Cyanide in on-site groundwater reached its highest concentration of approximately 100 ug/l in MW-5D in 2002; however, concentrations in MW-5D have been decreasing since that time. Total chromium in MW-5C was non-detect for the first seven out of nine sampling rounds and has increased since then.

Of the ten decreasing trends, the most significant are for arsenic in MW-3A, zinc in MW-4B, trichloroethene in MW-5C, vinyl chloride in MW-5C, and zinc in MW-5C.

The wells that had either stable concentrations or stable and decreasing concentrations for all eight COCs were:

MW-3A (one downward trend)
MW-4A (two downward trends)
MW-5A (two downward trends)

The wells that had either stable concentrations or stable and increasing concentrations for all eight COCs were:

MW-3B (one upward trend)
MW-5B (one upward trend)
MW-5D (one upward trend)

Wells that exhibited both upward and downward trends as well as stable concentrations were MW-5C, which had four downward trends and one upward trend, and MW-4B, which had one downward trend and two upward trends.

Excluding the first two years of monitoring, which were used as "baseline data," there have been approximately seven years of O&M monitoring. For these first seven years of O&M, trend analyses indicate that water quality has shown more improvement in the shallow aquifer than in the intermediate aquifer. Five of the ten downward trends were seen in deeper wells. All but one of the six increasing trends occurred in the intermediate aquifer.

ACL Exceedences

From 1999 through 2006, there have been 94 exceedences of the preliminary or final ACLs at the Auto Ion site. The number of possible times an ACL could have been exceeded, that is, the total number of data points, is 1,992. Therefore, an ACL exceedence occurred in approximately 5% of the sampling data. Twenty-eight of these 94 exceedences, less than 1.5% of the almost 2,000 data points, were confirmed as an exceedence in the subsequent round of sampling (see Attachment 19 for a table showing initial and confirmed exceedences). Of these 28 confirmed exceedences, over half (16) were shown to not be statistically significant when compared to background concentrations. In the remaining twelve cases, the only two compounds at levels statistically significant compared to background were total chromium and cyanide. The twelve exceedences, which represented less than 1% of all the data collected over the seven-year period, were evaluated using the method developed in the Remedial Action Plan for assessing whether there might be a concern about adverse impacts to the Kalamazoo River. None of the results exceeded the surface water quality criteria after taking into consideration the mixing zone. Consequently, the subsequent steps outlined in the RAP about how to respond to an ACL exceedence were not necessary.

Of particular concern to MDEQ are recent exceedences of the ACL for mercury in both upgradient and on-site wells. Prior to the end of 2001, mercury was not found above detection limits in any of the wells. None of the ACL exceedences for mercury, however, were statistically above background concentrations, and none required comparison to surface water quality criteria.

Background Monitoring Wells

The two upgradient monitoring wells are approximately 200 feet north of the Auto Ion site. The wells are located adjacent to Mills Street, immediately upgradient of the site, in the area that was formerly an auto impound lot. The wells are downgradient of the railroad yard on the east side of Mills Street. High concentrations of sodium, thought to be attributable to road salt, have been seen in the shallow upgradient well. In addition, some COCs, including mercury, have been detected in the wells. Additional potential for aquifer contamination from road salt also exists because of the flush mount casings on the wells. The outer casings are often found to be filled with water when the covers are removed prior to sampling.

The proximity of the upgradient wells to the site and to other potential sources of contamination, along with the periodic reversal of groundwater flow due to the river, make it difficult to conclusively identify the source of contaminants that show up in the groundwater collected from the upgradient wells. Another aspect of the current upgradient wells that makes them less than optimal is that they are not as affected by recharge from the Kalamazoo River as the on-site wells, and do not exhibit the same geochemistry.

The Settling Defendants installed several borings and collected groundwater samples from two areas across the river to investigate possible locations for supplemental background wells. The new upgradient wells would provide additional data to ascertain what contamination in site monitoring wells may be due to the auto impoundment lot, the railyard, and river water. As part of the follow-up actions to the five-year review, USEPA and the Settling Defendants will continue to explore options for installation of additional background wells.

Summary

The Auto Ion OU1 remedy removed highly-contaminated soils that served as a source of contamination to groundwater. The intent of the OU2 remedy is to monitor levels of COCs in groundwater, compare groundwater results to ACLs, background levels and surface water quality criteria to ensure no adverse impacts to the Kalamazoo River are occurring, and allow groundwater to naturally attenuate and improve over time. The groundwater monitoring results collected during the seven years of post-baseline O&M are consistent with the remedy and show that contaminant concentrations in groundwater are predominantly stable with some increasing and some decreasing trends. No ACL exceedences raised a concern about adverse impacts to the Kalamazoo River based on the criteria and methodology set forth in the RAP.

Given the complexity of subsurface geology and the nature of contaminants in soil (e.g., the intermittent desorption of contaminants from soil and subsequent release into groundwater), attenuation of contamination is not expected to proceed in a predictable way. Although the OU2 ROD indicates that a significant decrease in contaminant levels could be seen after the first five years of O&M, it also projected a timeframe of 50 to 60 years for achievement of groundwater cleanup levels. At the time of this five-year review, twelve years have elapsed since site soil was addressed. The 50 to 60 year timeframe was based on the rate at which nickel, the COC with the highest tendency to adsorb to the types of soil at the Auto Ion site, would be removed from the aquifer. According to the groundwater transport model used in the OU2 Feasibility Study, the concentrations of nickel in groundwater would be expected to decrease between 18% (for silty clay) and 90% (for sand) ten years after the 1994 soil excavation. Results of future monitoring will provide more data on which to assess the progress toward cleanup goals.

Site Inspection

The five-year review site inspection of the Auto Ion site was conducted on June 28, 2006, by Mary Tierney, USEPA Remedial Project Manager, Mary Schafer, MDEQ, and Joe Branch, Conestoga Rovers & Associates, the consulting firm representing the Settling Defendants. The objectives of the inspection were to assess the general condition of the site, monitoring wells, and piezometers, and ensure records and site documents are available and up-to-date. (See Attachment 20 for site inspection notes and notes on monitoring wells.) The intent was to collect information to assess the protectiveness of the remedy and to foresee any future remedy implementation problems and needs. Interviews with residents in the area were conducted on June 28, 2006. Perspectives and comments about the site from the interviews are summarized in the Community Involvement section of this report.

VII. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

The Auto Ion OU1 remedial action removed a large amount of contaminated soil from the site that was a source of contamination to the groundwater and posed a risk to human health. OU2 provides monitoring data that indicates that the site groundwater contaminants are predominantly stable. Over time, the site groundwater contamination is expected to naturally attenuate to cleanup levels identified in the OU2 ROD. There have been some cases of exceedences of the groundwater ACLs; however, no adverse effects to the Kalamazoo River have been identified. Consistent with the OU2 selected remedy, therefore, no additional action is needed at this time. Information from the site inspection indicates that the site fence and sign are effective in deterring trespassing and protecting site monitoring wells. The O&M is being properly conducted by the Settling Defendants. These portions of remedial action are functioning as intended by the site RODs.

There is some concern that the current upgradient groundwater monitoring wells are not optimally located. It is recommended that possible locations for supplemental background wells be investigated.

The site institutional controls limiting the use of site groundwater as drinking water are not yet in place. This deficiency should be addressed as soon as possible.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

The exposure assumptions, toxicity data, cleanup levels, and remedial action objective used at the time of the remedy selections are still valid. Human health and environmental protection are still provided by the remedy.

Changes in Standards and To-Be-Considered Requirements:

A list of ARARs is included in Attachment 21. Subsequent to the ROD for OU2, the State of Michigan codified its Groundwater/Surface Water Interface (GSI) Criteria in Rule 716, on December 21, 2002. This rule states that if: (1) a hazardous substance in groundwater is reasonably expected to vent to a surface water of the state; and (2) the concentration of a hazardous substance in groundwater exceeds the generic GSI criteria, then a response activity must be performed. The hazardous substances in the Auto Ion groundwater vent to the Kalamazoo River. The selected site remedy allows natural attenuation of the groundwater contamination and requires groundwater monitoring until eight consecutive sampling events demonstrate groundwater concentrations at or below Michigan Act 245, Rule 57 and Rule 82, as applicable; GSI values; or USEPA maximum contaminant limits, whichever is more stringent at the time of groundwater sampling. The selected site remedy provides for eventual groundwater cleanup to no less than GSI values and is protective as established in the site risk assessment.

Although GSI values are not part of the performance objectives included in the OU2 ROD for the Auto Ion site, they are standards that MDEQ considers when it is reviewing sites near surface water bodies. MDEQ developed site-specific GSI values for the Auto Ion site for several compounds in 2001 and for several other COCs in 2003. Statistical tests show there for fifty-six potential cases (seven COCs at eight different wells) over the course of almost ten years (1997 through 2006), there were only two exceedences of site-specific GSI values. Tests on mercury results were not run because the GSI for mercury is equal to zero. The two GSI exceedences were for cyanide at MW-5B and nickel at MW-5D (see Attachment 22). The site-specific and generic GSI values for the eight compounds of concern are shown below.

Compound	Generic GSI Value (ug/l)	Site-Specific GSI Value (ug/l)
Arsenic	50	680 (2001)
Chromium (total)	88	4,000 (2003)
Cyanide	5.2	44 (2001)
Mercury	0	0 (2003)
Nickel	77	6,600 (2001)
Trichloroethene	94	3,500 (2003)
Vinyl chloride	6.1	17,000 (2003)
Zinc	109	1,200 (2001)

In the June 2003 memorandum from MDEQ, the following six compounds were listed as being of no concern: lead; barium; trichloroethene; vinyl chloride; 1,2-dichloroethane; and bis(2-ethylhexyl)phthalate.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

No changes in exposure pathways or contaminant characteristics or toxicity have been noted.

Changes in Risk Assessment Methods

There have been no changes in standardized risk assessment methodologies that could affect the protectiveness of the remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has arisen that would call into question the protectiveness of the remedy.

Technical Assessment Summary

The Auto Ion site has been addressed via a removal action, a source control operable unit, and a groundwater operable unit. As intended by the ROD for OU1, the source of contamination was removed by excavating over 24,000 tons of soil from the 1.5 acre site. Approximately two-thirds of the site soils were removed to a depth of 3 feet bgl, and approximately one-third of the site was excavated to depths of between 3 and 10 feet bgl. Cleanup levels for the soil up to the water table were based on either background levels or levels of acceptable risk. The exposure pathways via ingestion, inhalation and dermal contact with soil have been eliminated, and exposure to contaminants remaining in groundwater will be ensured using institutional controls.

The Sediment Toxicity Evaluation showed that species in the Kalamazoo River were not being impacted by site contaminants. ACLs were devised to ensure that contamination at the site remained near levels seen during the first two years of O&M monitoring. Exceedences of ACLs have been compared to surface water quality criteria to identify contamination entering the river that would be of potential concern. No concerns have been identified.

VIII. ISSUES

The issues identified during this five-year review that may affect the protectiveness of the remedy are shown below in Table 4.

Table 4 - Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Lack of institutional controls to prevent use of groundwater beneath the site for drinking.	N	Y
Lack of a plan for assessing the effectiveness of and monitoring compliance with institutional controls.	N	Y

One issue discussed in this review that does not appear in the table is that the current upgradient wells for the site may not be optimally located. This is not included because although the wells are not optimal, the monitoring data from them does provide adequate background data and allows site data to be effectively evaluated. Therefore, this issue does not affect the protectiveness of the remedy. Because of the general location of the Auto Ion site and nearby facilities, establishing another background well location may not be feasible. Two alternate locations have already been investigated for this purpose but were found to be unsuitable. As part of the follow-up to this five-year review, options for locations of supplemental upgradient wells will be reviewed. If appropriate location(s) are identified, the Settling Defendants will complete investigatory borings and collect groundwater samples in the area(s). USEPA will review the results of the investigations and, in consultation with MDEQ, will determine whether it is appropriate to have the Settling Defendants install additional monitoring wells.

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 5 - Recommendations and Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date[3]	Affects Protectiveness? (Y/N)	
					Current	Future
Lack of ICs to prevent use of groundwater beneath the site for drinking	Work with State to implement ICs	Settling Defendants and MDEQ	USEPA	March 2007	N	Y
Lack of an assessment of the effectiveness of the planned ICs and lack of an IC monitoring plan	Conduct an IC Study and develop an IC Plan [Note: ICs are needed for all areas that do not allow for unlimited use and unrestricted exposure. This may include both on- and off-site areas.]	Settling Defendants	USEPA and MDEQ	Complete IC Study by June 2007; develop IC Plan by December 2007	N	Y

X. PROTECTIVENESS STATEMENT

Based on a review of relevant documents, data, ARARs, risk assumptions, and the results of the site inspection, the remedy for the Auto Ion site is protective in the short term. There is no evidence of human exposure to site-related contaminants based upon the existing use of the Auto Ion property. To ensure the remedy continues to be protective in the long term, however, enforceable use restrictions running with the land and required by the OU2 ROD must be implemented. In addition, other ICs or use restrictions may be necessary to ensure the long-term protectiveness of the remedy.

XI. NEXT REVIEW

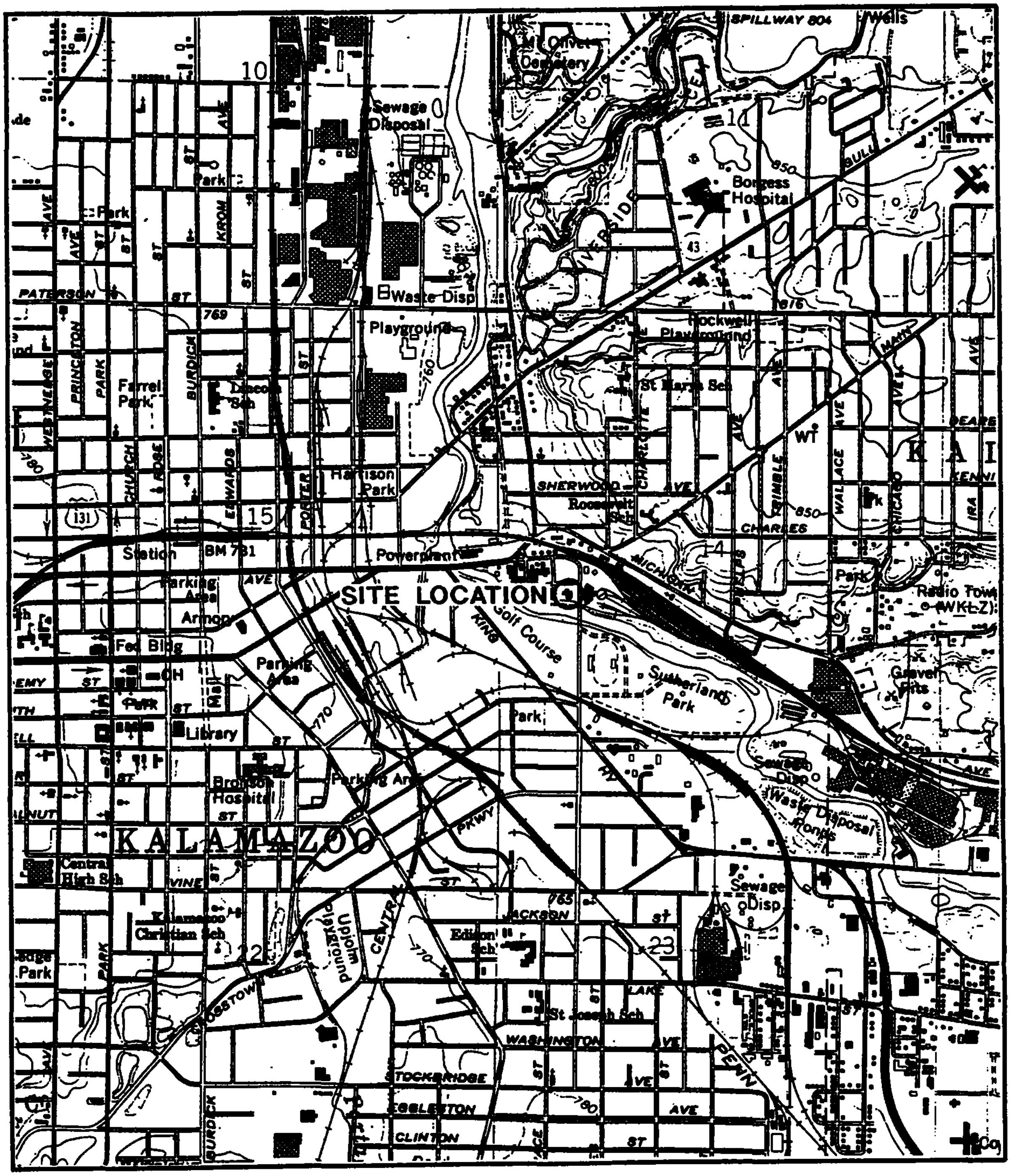
The next five-year review will be completed by September 2011, approximately five years from the date of this review.

[3] If USEPA, in consultation with MDEQ, determines that completion of the IC Study prior to implementing groundwater restrictions is advisable, the milestone dates in this table may change, e.g., the dates for completion of the IC Study and the implementation of groundwater controls may be revised to March 2007 and June 2007, respectively.

ATTACHMENTS

ATTACHMENT 1

FIGURE 1–1



0 2000'

U.S. Geological Survey
Kalamazoo Quadrangle
Michigan

Figure 1: Site Location Map
Auto Ion Five-Year Review
September 2006

SITE LOCATION MAP

AUTO ION SITE
KALAMAZOO, MICHIGAN

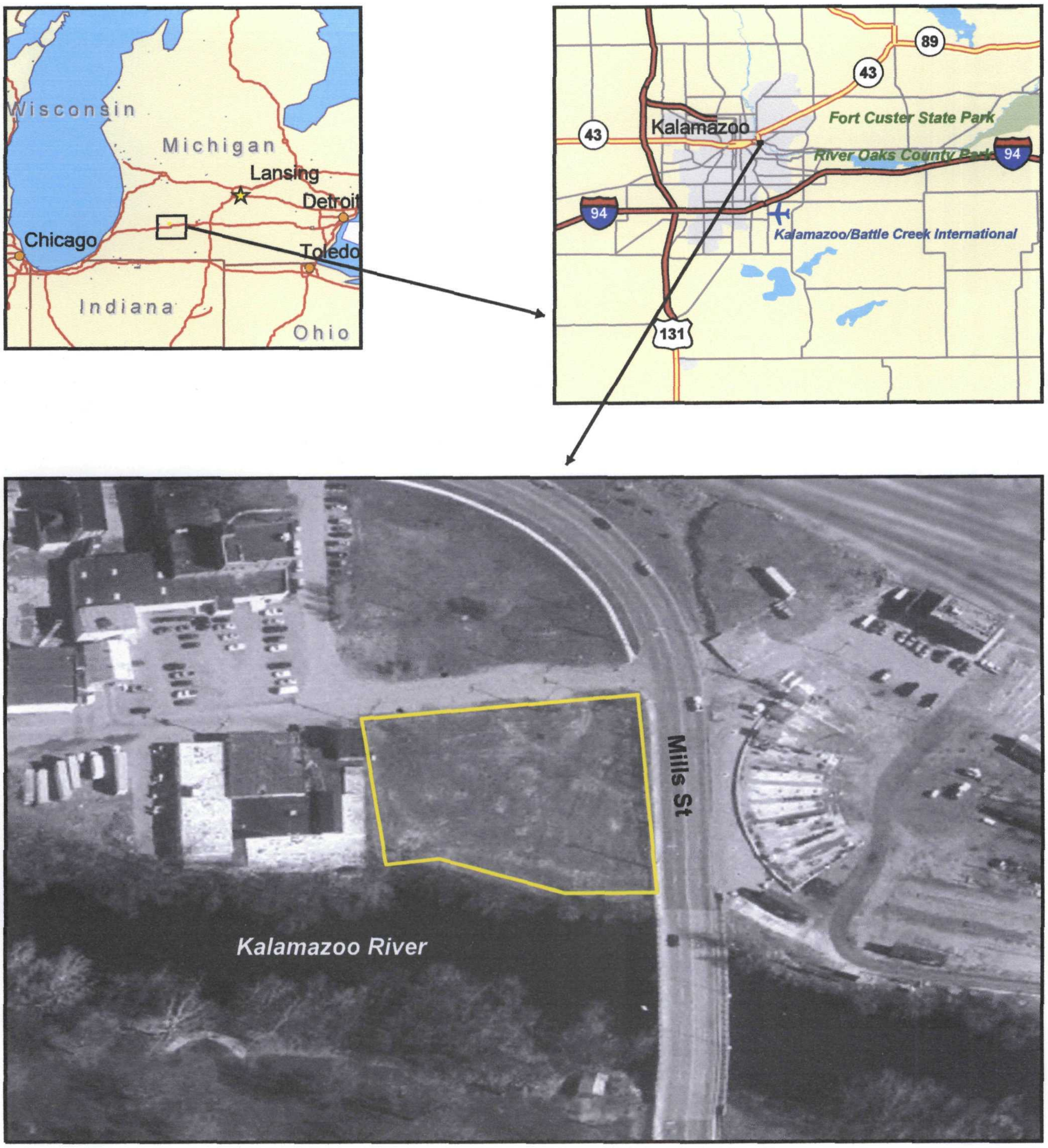
MS684010

Site Location

Superfund
U.S. Environmental Protection Agency

Auto Ion Chemicals
Kalamazoo County, MI

MID980794382



Created by Sarah Backhouse
U.S. EPA Region 5 on 6/28/2006

Site Boundary

N

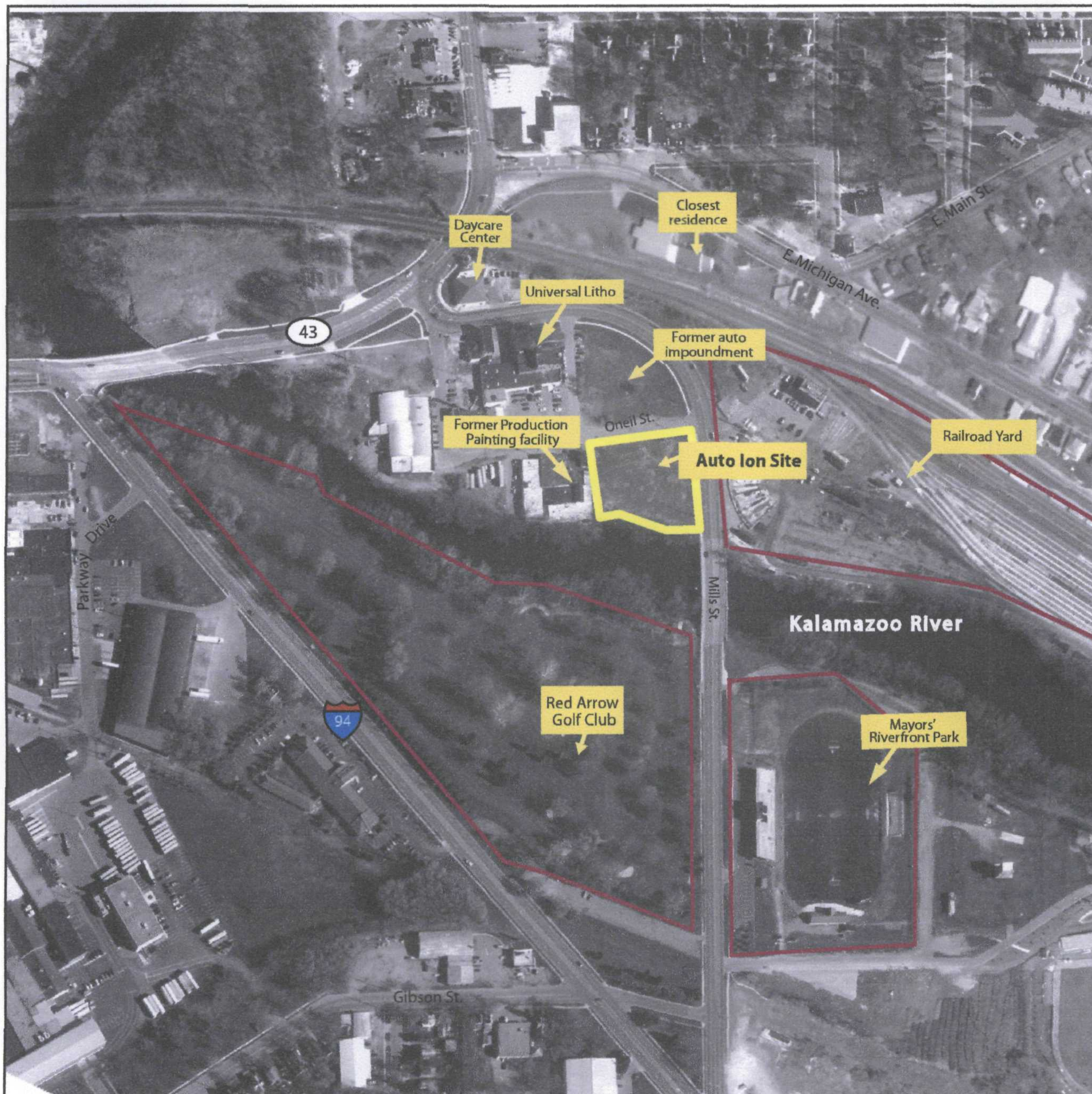
Figure 2: Site Map and Aerial Photo
Auto Ion Five-Year Review
September 2006

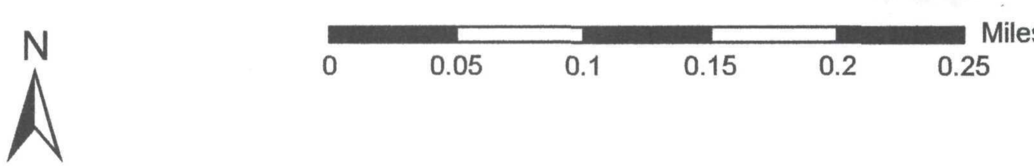
Features Near Auto Ion Site

Superfund
U.S. Environmental Protection Agency

Auto Ion Chemicals, Inc.
Kalamazoo, MI

MID980794382





GEOS
Groundwater Evaluation and Optimization System

Plot created by Julie Schilf
US EPA Region 5 on 7/5/2006

Figure 3: Features in Site Area
Auto Ion Five-Year Review
September 2006

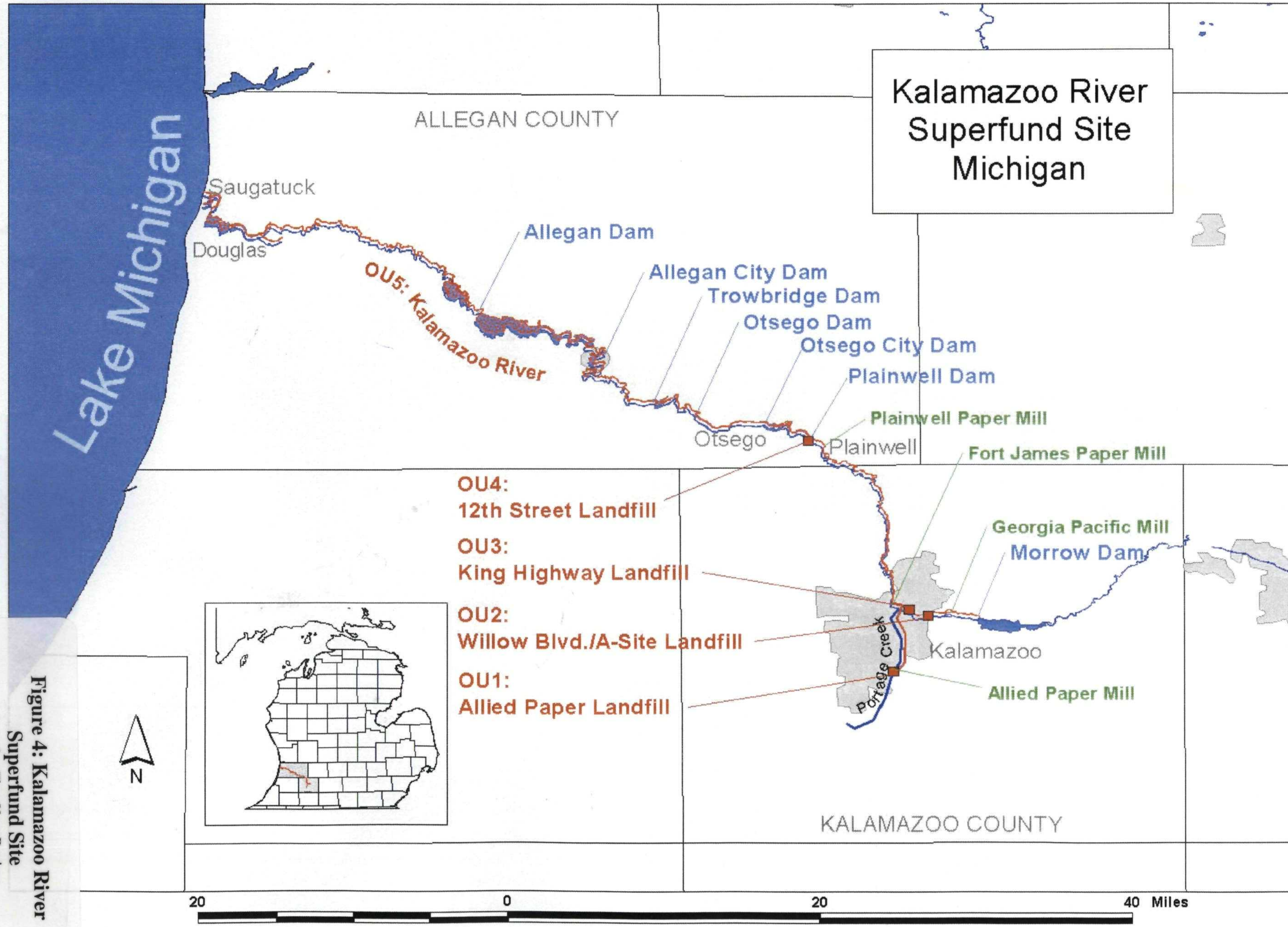


Figure 4: Kalamazoo River Superfund Site
Auto Ion Five-Year Review
September 2006

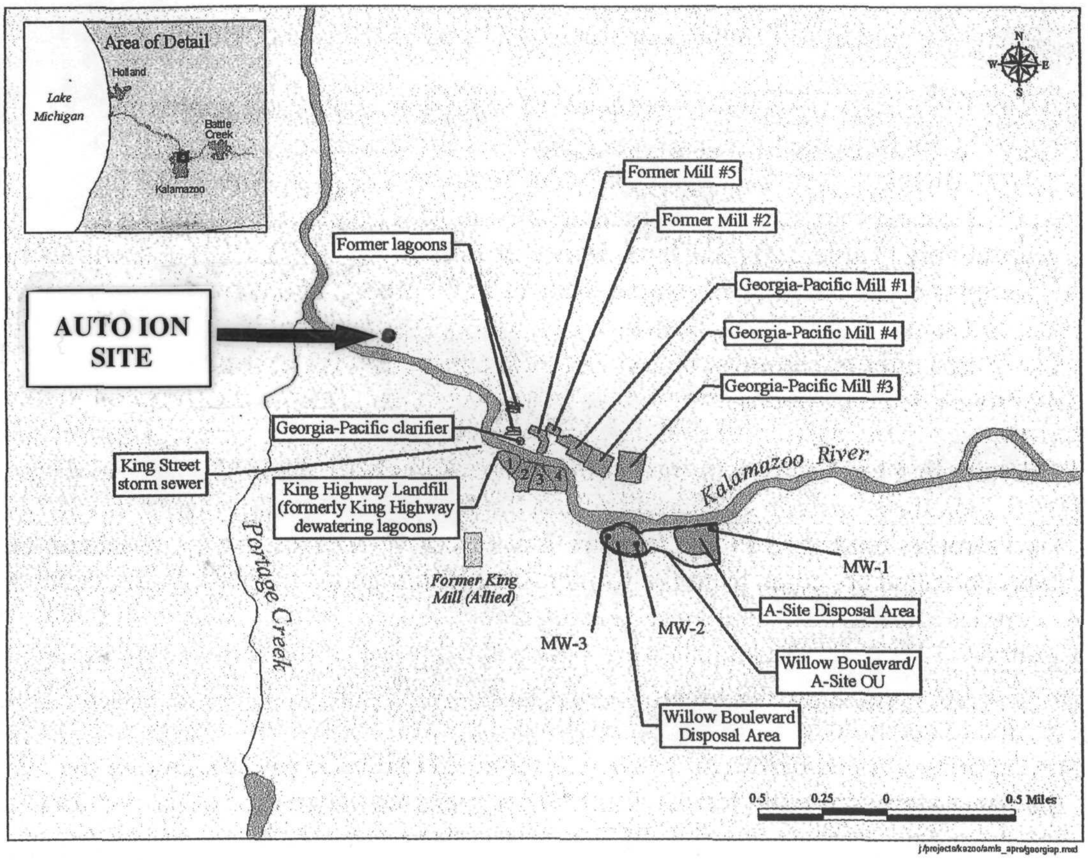


Figure 2.4. The Georgia-Pacific paper mill and surrounding facilities.

Figure 5: Kalamazoo River Superfund Site – Historical Discharges
Auto Ion Five-Year Review
September 2006

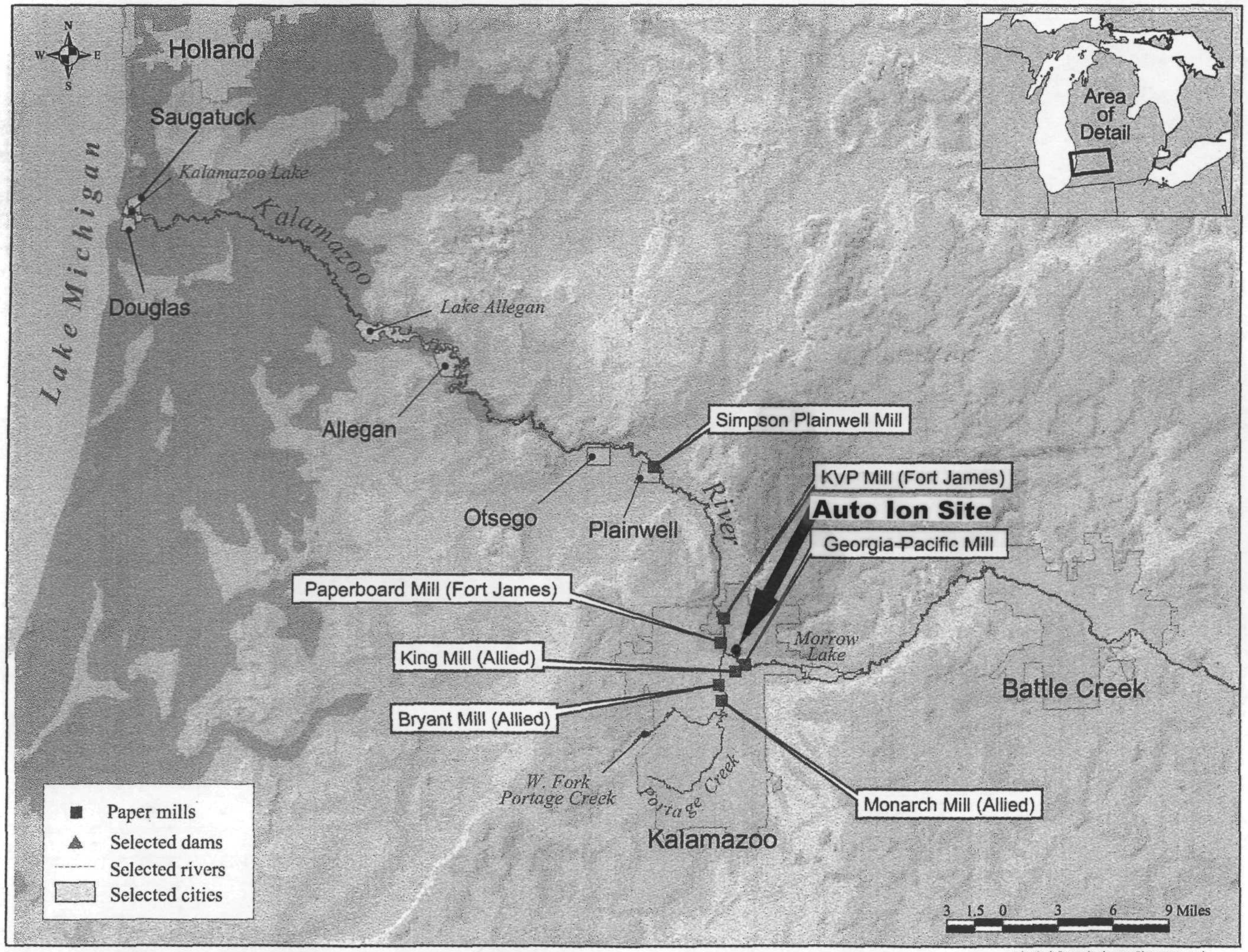


Figure 1.2. Location of current and former PRP paper mill facilities.

Figure 6: Kalamazoo River Superfund Site – Potential PCB Source Areas
Auto Ion Five-Year Review
September 2006

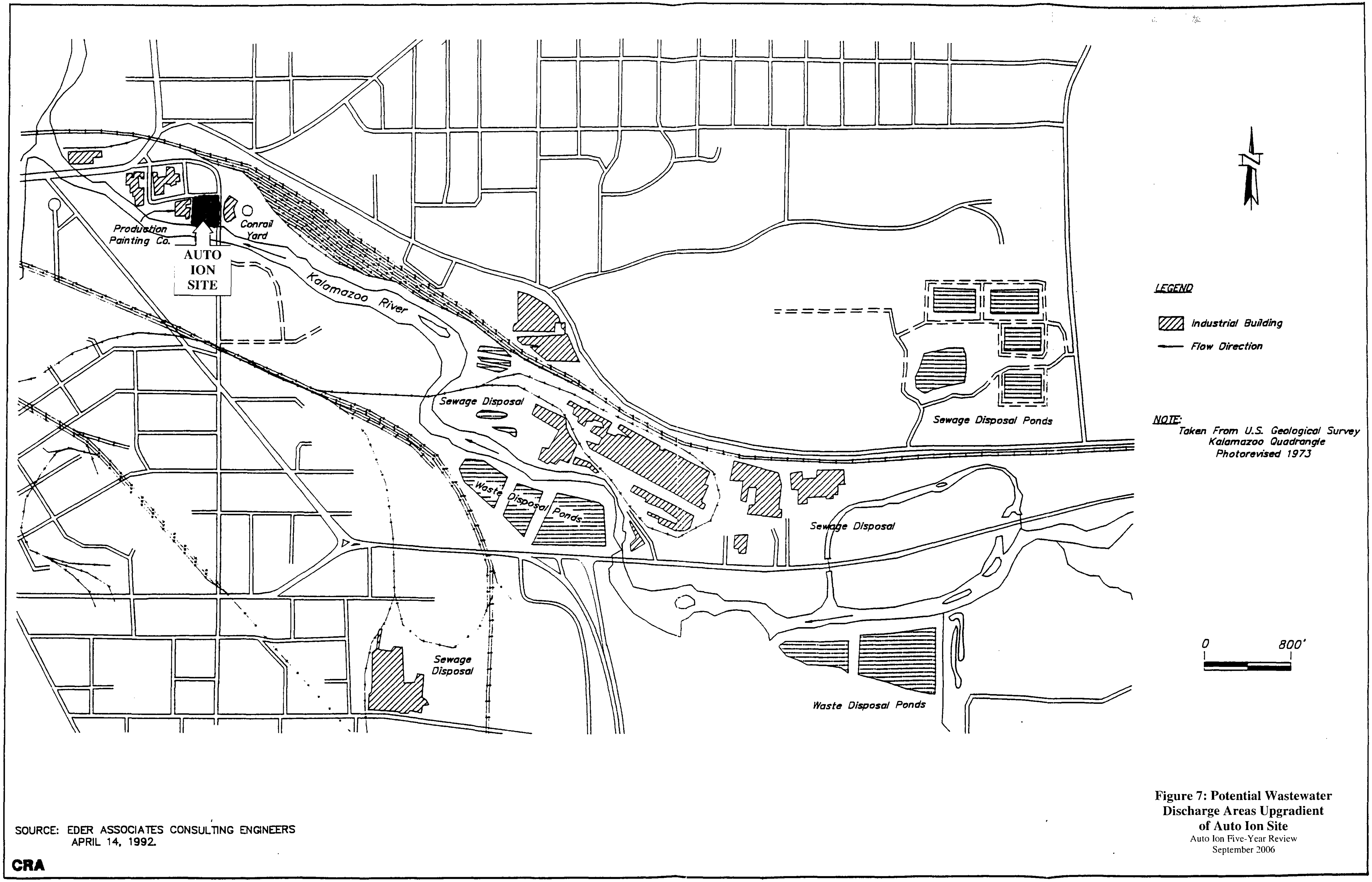


Figure 7: Potential Wastewater Discharge Areas Upgradient of Auto Ion Site

Auto Ion Five-Year Review
September 2006

4321(2)–JUN.1/92–REV.0

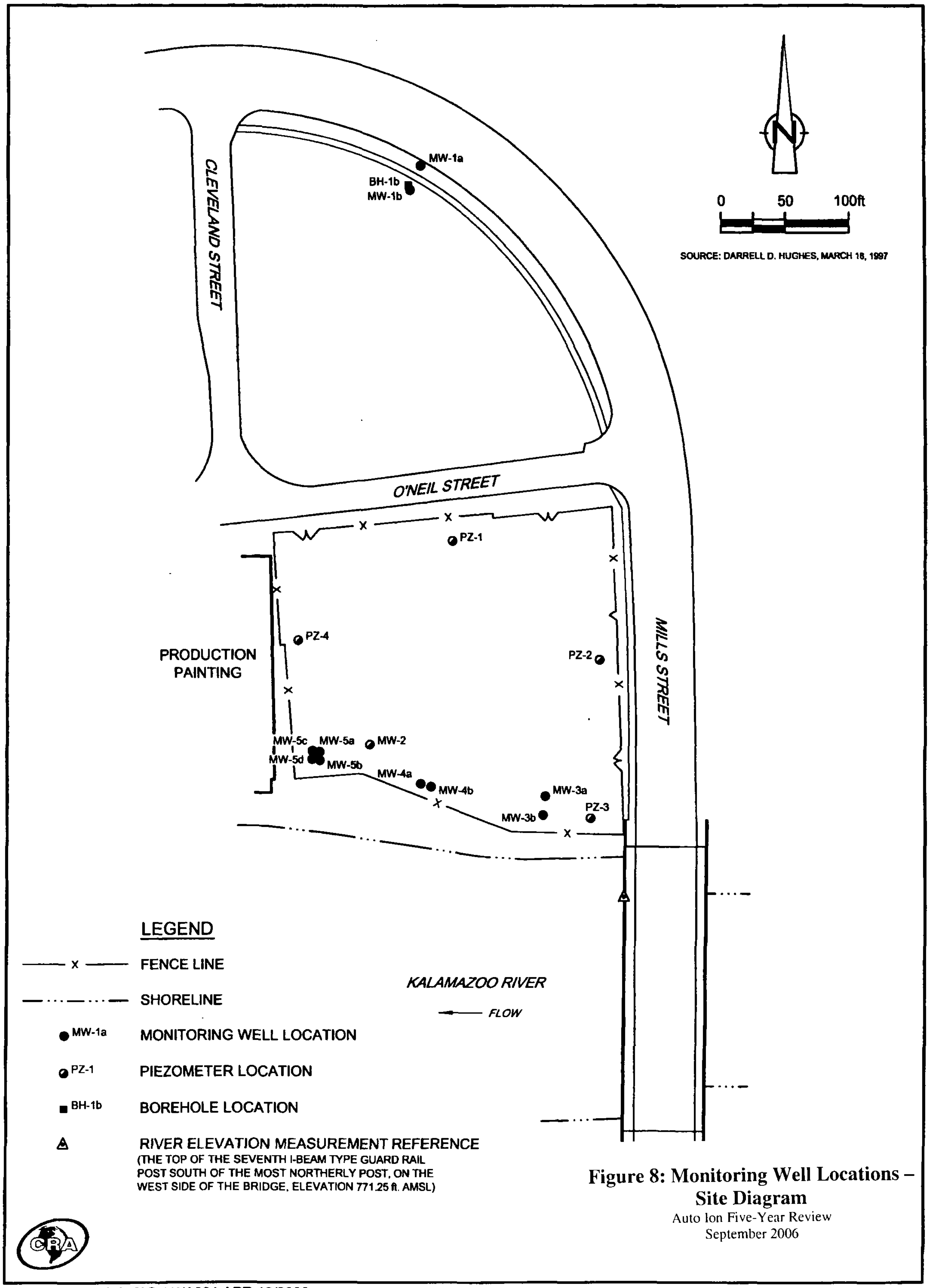


Figure 8: Monitoring Well Locations – Site Diagram

Auto Ion Five-Year Review

September 2006

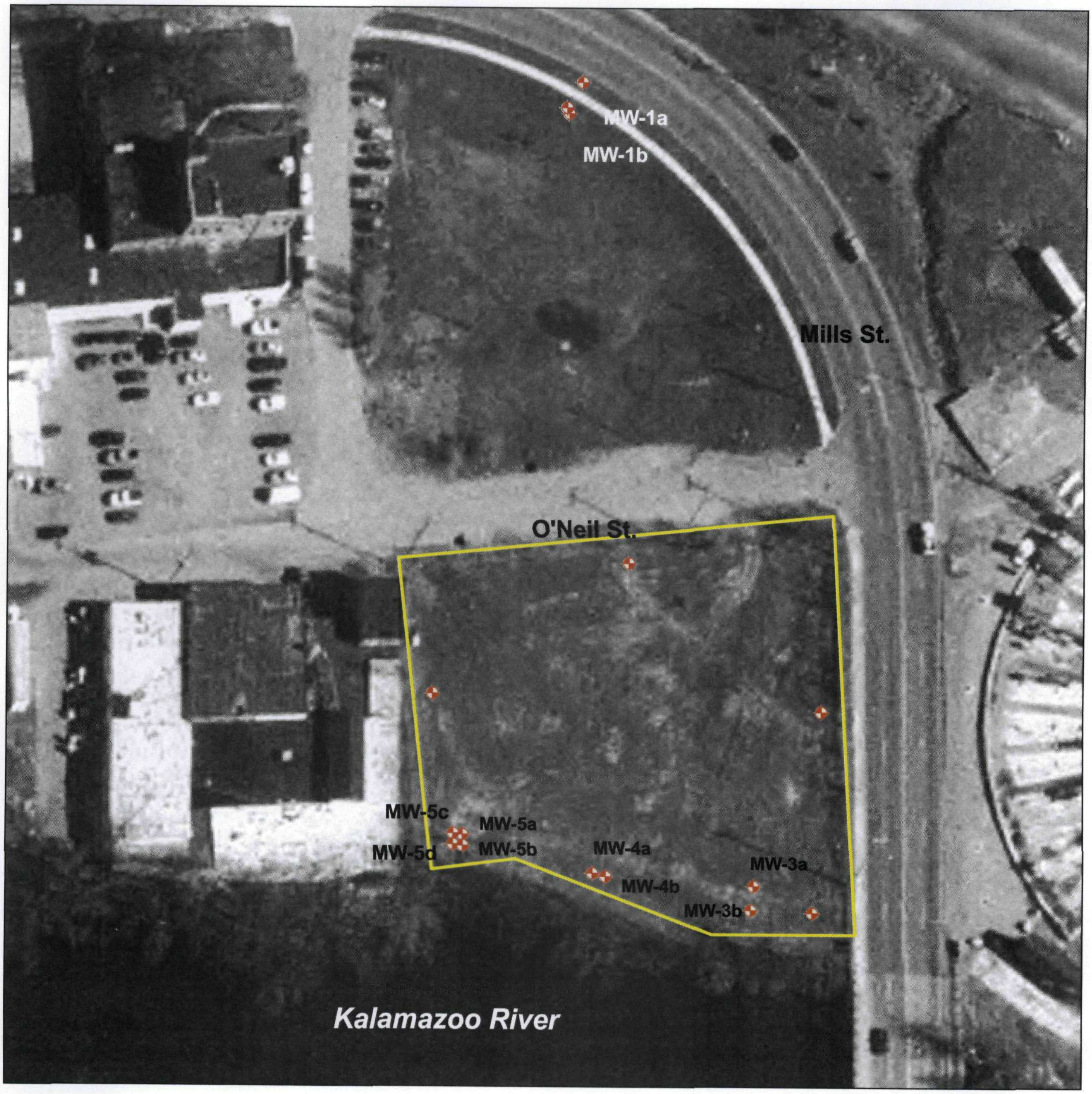
09182-01(TIER070)GN-WA001 APR 19/2006

Site Monitoring Well Locations

Superfund
U.S. Environmental Protection Agency

Auto Ion Chemicals, Inc.
Kalamazoo, MI

MID980794382



Legend

Site Boundary

Well Locations selection

N

110

Feet

Created by Julie Schiff
U.S. EPA Region 5 on 5/30/2006

GEOS

Figure 9: Monitoring Well Locations – Aerial Photograph

Auto Ion Five-Year Review
September 2006

ATTACHMENT 2

Amended and Restated Brownfield Plan
Tenth Amendment, May 2005

http://www.kalamazoocity.org/docs/Brownfield%20Plan%2010.pdf

7) Auto Ion Area

Eligible Property
50 Mills Street, CCN #06-14-307-001
74 Mills Street, CCN #06-14-312-026
910 O'Neil Street, CCN #06-14-311-033

The three parcels that comprise the Auto Ion Area site total approximately 3.4 acres. 50 Mills Street is city-owned and formerly utilized for storage of impounded motor vehicles. 74 Mills Street is the Auto Ion property, currently owned by the state and scored as a federal National Priorities List (Superfund) site (this parcel is also situated adjacent to the west of a contaminated site known as "Conrail Botsford Yards"). 910 O'Neil is a vacant, undeveloped city-owned parcel situated on the Kalamazoo River (this parcel is situated adjacent to the west of a contaminated site known as "Production Painting").

Basis of Eligibility
This site is listed as a known site of environmental contamination with the Michigan Department of Environmental Quality Environmental Response Division and with the United States Environmental Protection Agency Comprehensive Environmental Response, Compensation and Liability Information System (Facility ID MID980794382). In 1993, an excavation of all soil above the water table was conducted at 74 Mills Street, due to the presence of metals (arsenic, cadmium, chromium, lead, and nickel) and polynuclear aromatic hydrocarbons (benzo(a)pyrene). Remaining contaminants in groundwater qualifying the site as a "facility" (per Natural Resources and Environmental Protection Act, P.A. 451, of 1994, as amended) include chlorinated solvents (vinyl chloride, trichloroethene) and metals (arsenic, cadmium, lead, nickel).

The Plan (pursuant to Section 13(1), Act No. 381 of 1996)

a. A description of the costs of the Plan intended to be paid for with the tax increment revenues;

b. A brief summary of the eligible activities that are proposed for each eligible property.
The USEPA has determined that "natural attenuation" is the acceptable cleanup alternative for the Auto Ion site (74 Mills); groundwater contamination will be allowed to slowly discharge into the Kalamazoo River, with periodic monitoring to ensure contaminant levels do not increase significantly. Reportedly, the entire 74 Mills Street parcel has been filled with clean soil, minimizing the likelihood that additional remedial activities will be necessary.

Eligible activities which may rely on tax increment revenues include Phase I and II Environmental Site Assessments at 50 Mills and 910 O'Neil as well as Baseline Environmental Assessments (including Section 7a Compliance Analyses) for all three parcels. Based on environmental efforts already undertaken at the site, the Phase I and II Environmental Site Assessment portions of a BEA should be accomplished for approximately $20,000 (one time only cost). The maximum fee for compiling a BEA for the site, including Section 7a considerations, would be approximately $5,000 for each user. The total number of potential users is estimated at three.

c. An estimate of the captured taxable value and tax increment revenues for each year of the

Plan from each parcel of eligible property.
Estimate of Captured Taxable Value: Assuming market potential for a mix of commercial, office, light industrial and/or recreational uses for the three separate parcels, which range in size from about one-half acre to about 1.5 acres, a maximum estimate of potential investment value is $1.2 million. This yields a taxable value of $600,000.
Estimate of Tax Increment Revenues: Applying the rate of 62.0901 mills to the estimated value range, the projected annual tax increment revenue for the site is $37,254 for years 1 after expenditure of funds for eligible activities under the Plan.

It is the intent of the Authority to capture all tax increment revenue on real and personal property generated by new development on the site. These tax increments will be captured for up to five years after the time that capture is required for the purpose of paying the costs of eligible activities on the Auto Ion Area.

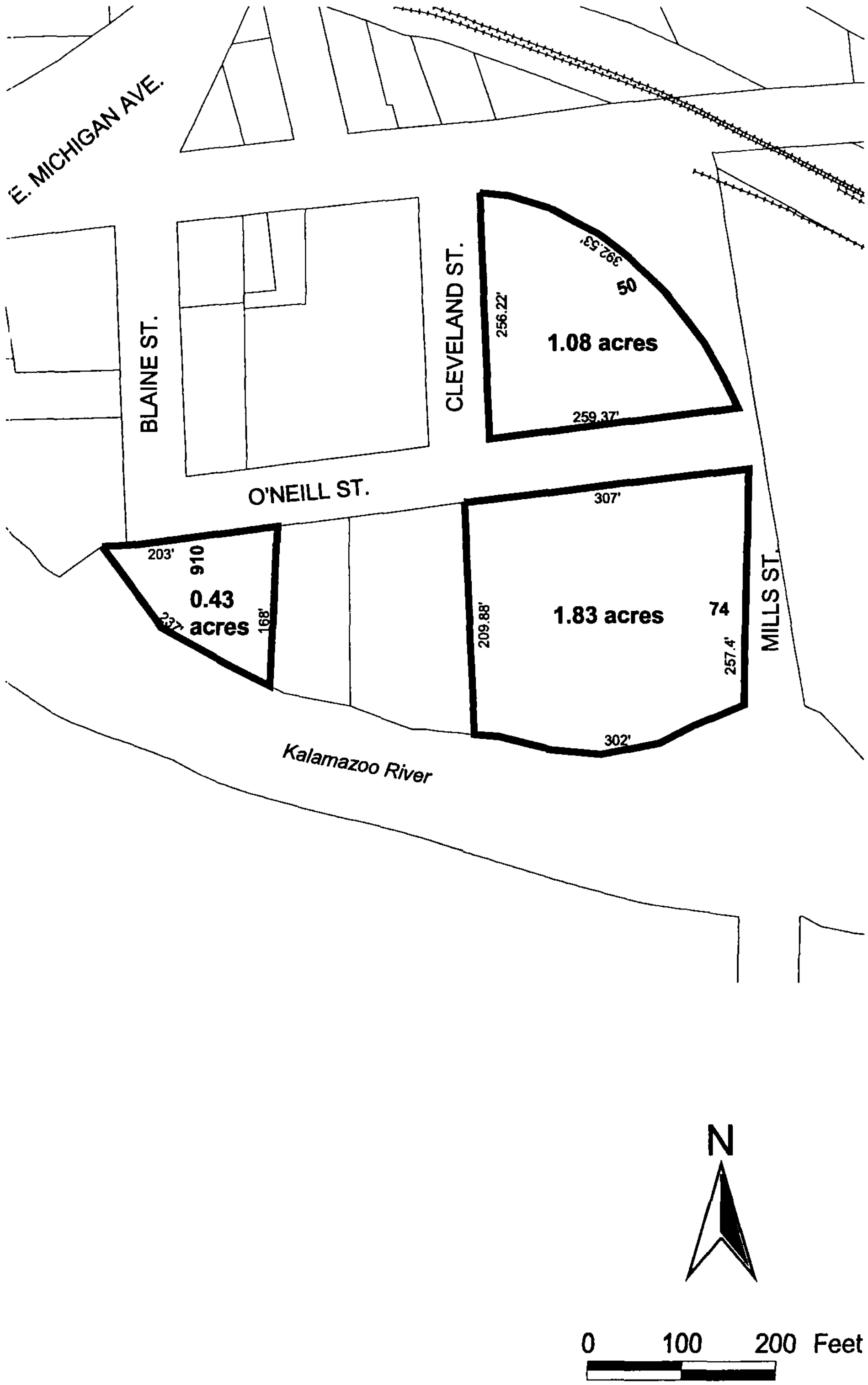
g. Maximum Estimated Impact of Tax Increment Financing on Taxing Jurisdiction.
Taxing Unit
Millage
Rate
Maximum Estimated
Annual Taxes
Captured by
Authority
KVCC 2.8135 $1,688
Metro Transit 1.0000 $600
KPS Operating 18.0000 $10,800
City Operating 19.2705 $11,562
Solid Waste 1.8700 $1,122
County 6.1362 $3,682
KRESA 3.0416 $1,825
State Educ. Tax 6.0000 $3,600
Kal. Library 3.9583 $2,375
TOTAL 62.0901 $37,254
Maximum estimated annual taxable value = $600,000

h. A legal description of each parcel of eligible property to which the Plan applies, a map showing the location and dimensions of each eligible property, and a statement of whether personal property is included as part of the eligible property.

50 MILLS STREET : T ONEILLS PLAT UNION ADDITION LOTS 15-16-17-18-19-20-21-22.
74 MILLS STREET: T ONEILLS PLAT UNION ADDITION LOTS 23-24-25-26-27-28.
910 O=NEIL STREET: T ONEIL PLAT, UNION ADDITION LOT 32, EXC E 14 FT. ALSO LOTS 33 & 34. ALSO RIPARIAN RIGHTS.

For location and dimensions of property, see attached site diagram. Personal property will be included as part of the eligible property.

SITE LOCATION: AUTO ION AREA



Attachment 2: Excerpt and Map from City of Kalamazoo Brownfield Plan (page 3 of 3)

2/03 TKS

ATTACHMENT 3

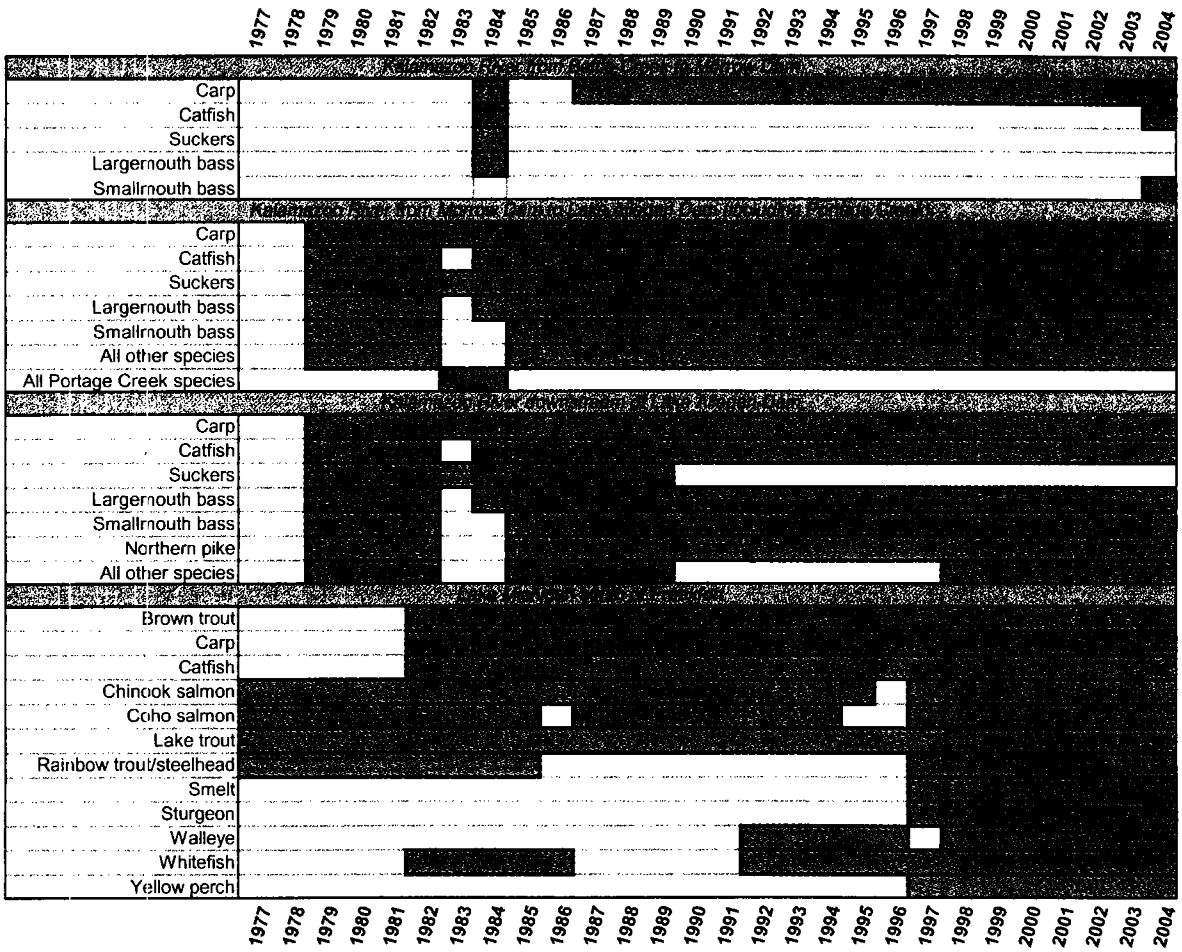


Figure 5.1. History of fish consumption advisories in the Kalamazoo River and Lake Michigan south of Frankfort. Orange bars indicate years in which there was an advisory of any kind.

Sources: MDNR, 1977, 1978a, 1979, 1980, 1981b, 1982, 1983, 1984a, 1985, 1986, 1987c, 1988, 1989, 1990a, 1991, 1992a, 1993a, 1994a, 1995-2001; U.S. EPA, 1997a; MDCH, 2002, 2003, 2004.

5.3.2 Specific descriptions of the fish consumption advisories

Advisories in the Kalamazoo River and Lake Michigan issued by the MDCH have varied over their history (Tables 5.2 and 5.3). Many of the changes were due to changes in the way the advisories were defined, such as the length of fish that are under advisory or whether a separate advisory was issued for sensitive populations. Additionally, the geographic extent of advisories varied from year to year. For example, from 1979 to 1983, there was a separate advisory for Portage Creek, but after 1983, Portage Creek was included in the advisory for the Kalamazoo River from Morrow Dam to Lake Allegan Dam.

Table 5.2. MDCH fish consumption advisories for the Kalamazoo River, 1979-2004[a]

Species	Size	1979 to 1982[b]	1983[b]	1984[c]	1985 to 1986	1987 to 1989	1990 to 1993	1994 to 1995	1996	1997	1998 to 2000	2001 to 2002	2003 to 2004
Kalamazoo River from Battle Creek to Morrow Dam													
Carp	All			1,4		4	4	4	4	4	4	0,1	0,2
Catfish	All			1,4									0,2
Suckers	All			1,4									
Largemouth bass	All			1,4									
Smallmouth bass	14″-30″												0,1
Kalamazoo River from Morrow Dam to Lake Allegan Dam (including Portage Creek)													
Carp	All	4	4	1,4	4	4	4	4	4	4	4	4	4
Catfish	All	4		1,4	4	4	4	4	4	4	4	4	4
Suckers	All	4	4	1,4	4	4	4	4	4	4	4	4	4
Largemouth bass	All	4		1,4	4	4	4	4	4				
	14″-30″									4	4	4	4
Smallmouth bass	All	4			1,4	1,4	4	4	4				
	14″-30″									4	4	4	4
All other species		4			1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4
All species in Portage Creek		4	4										

Table 5.2. MDCH fish consumption advisories for the Kalamazoo River, 1979-2004 (cont.)[a]

Species	Size	1979 to 1982[b]	1983[b]	1984[c]	1985 to 1986	1987 to 1989	1990 to 1993	1994 to 1995	1996	1997	1998 to 2000	2001 to 2002	2003 to 2004
Kalamazoo River downstream of Lake Allegan Dam													
Carp	All	4	4	1,4	4	4	4	4	4	4	4	4	4
Catfish	All	4		1,4	4	4	4	4	4	4	4	4	4
Suckers	All	4	4	1,4	4	4							
Largemouth bass	All	4		1,4	4	4		1,4	4				
	14″-30″									1,4	1,4	1,4	1,4
	> 15″						1,4						
Smallmouth bass	All	4			1,4	1,4		1,4	4				
	14″-30″									1,4	1,4	1,4	1,4
	> 15″						1,4						
Northern pike	All	4			1,4	1,4		4	4				
	≥ 22″									4	4	4	4
	20″-25″						1,4						
	> 25″						4						
All other species	All	4			1,4	1,4					0,2	0,2	0,2

4 = No consumption.
2 = Limit consumption to 1 meal (0.5 lb) per month.
1 = Limit consumption to 1 meal (0.5 lb) per week.
0 = Unlimited consumption.
a. If there is only one symbol it is the advice for the whole population. When two numbers are shown, the first is the advice for the "general population" and the second is the advice for "children and women who are pregnant, nursing, or expect to bear children." From 1979 to 1983 children are not defined by age, from 1984 to 1987 the advice is for children age 6 and under, and from 1988 to 2004 the advice is for children age 15 and under.
b. From 1979 to 1983 there is a separate advisory for "all other species" in Portage Creek; thereafter Portage Creek species are included in the Kalamazoo River from Morrow Dam to Lake Allegan Dam advisory.
c. In 1984, the advice was for the Kalamazoo River and Portage Creek, with no distinction as to the reach.
Sources: MDNR, 1977, 1978a, 1979, 1980, 1981b, 1982, 1983, 1984a, 1985, 1986, 1987c, 1988, 1989, 1990a, 1991, 1992a, 1993a, 1994a, 1995-2001; MDCH, 2002, 2003, 2004.

ATTACHMENT 4

Table 7.1. Wildlife species observed in the Kalamazoo River Basin that utilize wetland habitat, and their protection status

Scientific name	Common name	Status[a]
Birds		
Podilymbus podiceps	Pied-billed grebe	
Ardea herodias	Great blue heron	
Ardea alba	Great egret	
Butorides virescens	Green heron	
Nycticorax nycticorax	Black-crowned night-heron	MI - SC
Cathartes aura	Turkey vulture	
Branta canadensis	Canada goose	
Cygnus olor	Mute swan	
Aix sponsa	Wood duck	
Anas rubripes	American black duck	
Anas platyrhynchos	Mallard	
Anas discors	Blue-winged teal	
Bucephala clangula	Common goldeneye	
Lophodytes cucullatus	Hooded merganser	
Pandion haliaetus	Osprey	MI - T
Haliaeetus leucocephalus	Bald eagle	US - T
Circus cyaneus	Northern harrier	MI - SC
Accipiter striatus	Sharp-shinned hawk	
Buteo jamaicensis	Red-tailed hawk	
Falco sparverius	American kestrel	
Phasianus colchicus	Ring-necked pheasant	
Bonasa umbellus	Ruffed grouse	
Meleagris gallopavo	Wild turkey	
Grus canadensis	Sandhill crane	
Charadrius vociferus	Killdeer	
Actitis macularia	Spotted sandpiper	
Scolopax minor	American woodcock	
Larus delawarensis	Ring-billed gull	
Chlidonias niger	Black tern	MI - SC
Columba livia	Rock dove	
Zenaida macroura	Mourning dove	
Coccyzus erythropthalmus	Black-billed cuckoo	
Coccyzus americanus	Yellow-billed cuckoo	
Otus asio	Eastern screech-owl	

Table 7.1. Wildlife species observed in the Kalamazoo River Basin that utilize wetland habitat, and their protection status (cont.)

Scientific name	Common name	Status[a]
Bubo virginianus	Great horned owl	
Strix varia	Barred owl	
Chaetura pelagica	Chimney swift	
Archilochus colubris	Ruby-throated hummingbird	
Ceryle alcyon	Belted kingfisher	
Melanerpes erythrocephalus	Red-headed woodpecker	
Melanerpes carolinus	Red-bellied woodpecker	
Sphyrapicus varius	Yellow-bellied sapsucker	
Picoides pubescens	Downy woodpecker	
Picoides villosus	Hairy woodpecker	
Colaptes auratus	Northern flicker	
Dryocopus pileatus	Pileated woodpecker	
Contopus virens	Eastern wood-pewee	
Empidonax virescens	Acadian flycatcher	
Empidonax traillii	Willow flycatcher	
Empidonax minimus	Least flycatcher	
Sayornis phoebe	Eastern phoebe	
Myiarchus crinitus	Great crested flycatcher	
Tyrannus tyrannus	Eastern kingbird	
Vireo flavifrons	Yellow-throated vireo	
Vireo solitarius	Blue-headed (solitary) vireo	
Vireo gilvus	Warbling vireo	
Vireo olivaceus	Red-eyed vireo	
Cyanocitta cristata	Blue jay	
Corvus brachyrhynchos	American crow	
Progne subis	Purple martin	
Tachycineta bicolor	Tree swallow	
Stelgidopteryx serripennis	Northern rough-winged swallow	
Riparia riparia	Bank swallow	
Petrochelidon pyrrhonota	Cliff swallow	
Hirundo rustica	Barn swallow	
Poecile atricapilla	Black-capped chickadee	
Baeolophus bicolor	Tufted titmouse	
Sitta carolinensis	White-breasted nuthatch	
Certhia americana	Brown creeper	

Table 7.1. Wildlife species observed in the Kalamazoo River Basin that utilize wetland habitat, and their protection status (cont.)

Scientific name	Common name	Status[a]
Thryothorus ludovicianus	Carolina wren	
Troglodytes aedon	House wren	
Cistothorus palustris	Marsh wren	MI - SC
Polioptila caerulea	Blue-gray gnatcatcher	
Sialia sialis	Eastern bluebird	
Catharus fuscescens	Veery	
Hylocichla mustelina	Wood thrush	
Turdus migratorius	American robin	
Dumetella carolinensis	Gray catbird	
Toxostoma rufum	Brown thrasher	
Sturnus vulgaris	European starling	
Bombycilla cedrorum	Cedar waxwing	
Vermivora pinus	Blue-winged warbler	
Vermivora peregrina	Tennessee warbler	
Parula americana	Northern parula warbler	
Dendroica petechia	Yellow warbler	
Dendroica pensylvanica	Chestnut-sided warbler	
Dendroica caerulescens	Black-throated blue warbler	
Dendroica virens	Black-throated green warbler	
Dendroica fusca	Blackburnian warbler	
Dendroica cerulea	Cerulean warbler	MI - SC
Setophaga ruticilla	American redstart	
Protonotaria citrea	Prothonotary warbler	MI - SC
Seiurus aurocapillus	Ovenbird	
Seiurus motacilla	Louisiana waterthrush	MI - SC
Oporornis philadelphia	Mourning warbler	
Geothlypis trichas	Common yellowthroat	
Piranga olivacea	Scarlet tanager	
Pipilo erythrophthalmus	Eastern towhee	
Spizella passerina	Chipping sparrow	
Spizella pusilla	Field sparrow	
Melospiza melodia	Song sparrow	
Melospiza georgiana	Swamp sparrow	
Cardinalis cardinalis	Northern cardinal	
Pheucticus ludovicianus	Rose-breasted grosbeak	

Table 7.1. Wildlife species observed in the Kalamazoo River Basin that utilize wetland habitat, and their protection status (cont.)

Scientific name	Common name	Status[a]
Passerina cyanea	Indigo bunting	
Agelaius phoeniceus	Red-winged blackbird	
Sturnella magna	Eastern meadowlark	
Quiscalus quiscula	Common grackle	
Molothrus ater	Brown-headed cowbird	
Icterus galbula	Baltimore oriole	
Carpodacus mexicanus	House finch	
Carduelis tristis	American goldfinch	
Coccothraustes vespertinus	Evening grosbeak	
Passer domesticus	House sparrow	
Amphibians		
Acris crepitans blanchardi	Blanchard's cricket frog	MI - SC
Ambystoma laterale	Blue-spotted salamander	
Ambystoma maculatum	Spotted salamander	
Ambystoma opacum	Marbled salamander	MI - T
Ambystoma tigrinum	Tiger salamander	
Bufo americanus	American toad	
Bufo fowleri	Fowler's toad	
Hemidactylium scutatum	Four-toed salamander	
Hyla versicolor	Gray treefrog	
Necturus maculosus	Mudpuppy	
Notophthalmus viridescens	Eastern newt	
Plethodon cinereus	Eastern red-backed salamander	
Pseudacris crucifer	Spring peeper	
Pseudacris triseriata	Western chorus frog	
Rana catesbeiana	American bullfrog	
Rana clamitans	Green frog	
Rana palustris	Pickerel frog	
Rana pipiens	Northern leopard frog	
Rana sylvatica	Wood frog	
Reptiles		
Apalone spinifera	Eastern spiny softshell	
Chelydra serpentina	Snapping turtle	
Chrysemys picta	Painted turtle	
Clemmys guttata	Spotted turtle	MI - T

Table 7.1. Wildlife species observed in the Kalamazoo River Basin that utilize wetland habitat, and their protection status (cont.)

Scientific name	Common name	Status[a]
Clonophis kirtlandii	Kirtland's snake	MI - E
Coluber constrictor foxii	Blue racer	
Diadophis punctatus edwardi	Northern ringneck snake	
Elaphe obsoleta obsoleta	Black rat snake	MI - SC
Emydoidea blandingii	Blanding's turtle	MI - SC
Graptemys geographica	Map turtle	
Eumeces fasciatus	Five-lined skink	
Heterodon platirhinos	Eastern hognose snake	
Lampropeltis trianguium traingulum	Eastern milk snake	
Nerodia sipedon sipedon	Northern water snake	
Opheodrys vernalis	Smooth green snake	
Regina septemvittata	Queen snake	
Sistrurus catenatus catenatus	Eastern massasauga rattlesnake	MI - SC; US- C
Sternotherus odoratus	Musk turtle (stinkpot)	
Storeria dekayi	Brown snake	
Storeria occipitomaculata occipitomaculata	Northern red-bellied snake	
Terrapene carolina carolina	Eastern box turtle	MI - SC
Thamnophis butleri	Butler's garter snake	
Thamnophis sauritus septentrionalis	Northern ribbon snake	
Thamnophis sirtalis sirtalis	Eastern garter snake	
Mammals		
Blarina brevicauda	Shorttail shrew	
Canis latrans	Coyote	
Castor canadensis	Beaver	
Condylura cristata	Starnose mole	
Cryptotis parva	Least shrew	MI - T
Didelphis marsupialis	Opossum	
Eptesicus fuscus	Big brown bat	
Erethizon dorsatum	Porcupine	
Felis rufus	Bobcat	
Glaucomys volans	Southern flying squirrel	
Lasionycteris noctivagans	Silver-haired bat	
Lasiurus borealis	Red bat	
Lasiurus cinereus	Hoary bat	

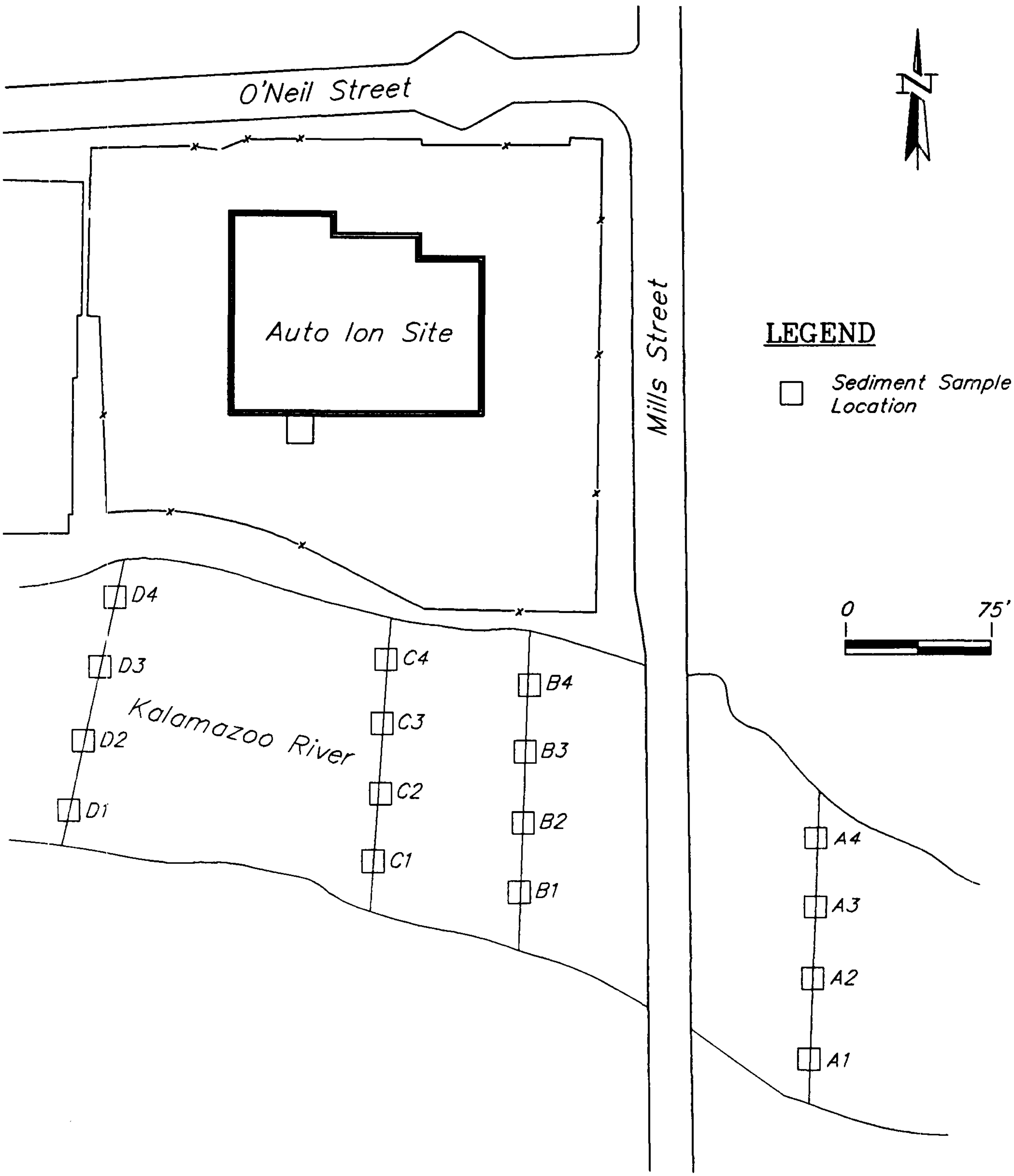
Table 7.1. Wildlife species observed in the Kalamazoo River Basin that utilize wetland habitat, and their protection status (cont.)

Scientific name	Common name	Status[a]
Lutra canadensis	River otter	
Marmota monax	Woodchuck	
Mephitis mephitis	Striped skunk	
Microtus pinetorum	Woodland vole	MI - SC
Microtus ochrogaster	Prairie vole	MI - E
Microtus pennsylvanicus	Meadow vole	
Mus musculus	House mouse	
Mustela erminea	Ermine	
Mustela frenata	Longtail weasel	
Mustela nivalis	Least weasel	
Mustela vison	Mink	
Myotis keenii	Keen's bat	
Myotis lucifugus	Little brown bat	
Nycticeius humeralis	Evening bat	
Odocoileus virginianus	Whitetail deer	
Ondatra zibethicus	Muskrat	
Peromyscus leucopus	White-footed mouse	
Peromyscus maniculatus	Deer mouse	
Procyon lotor	Raccoon	
Scalopus aquaticus	Eastern mole	
Sciurus carolinensis	Eastern gray squirrel	
Sciurus niger	Eastern fox squirrel	
Sorex cinereus	Masked shrew	
Spermophilus tridecemlineatus	Thirteen-lined ground squirrel	
Sylvilagus floridanus	Eastern cottontail	
Synaptomys cooperi	Southern bog lemming	
Tamias striatus	Eastern chipmunk	
Tamiasciurus hudsonicus	Red squirrel	
Taxidea taxus	Badger	
Urocyon cinereoargenteus	Gray fox	
Vulpes vulpes	Red fox	
Zapus hudsonius	Meadow jumping mouse	

a. State listings (MI) from Michigan Natural Features Inventory (2002); Federal (U.S.) from U.S. FWS (2003b). E = endangered, T = threatened, SC = special concern, C = under consideration for listing.

Source: Birds from Adams et al. (1998); other animals from Blasland, Bouck & Lee (2000c).

ATTACHMENT 5



SEDIMENT AND SURFACE WATER SAMPLE LOCATIONS TRANSECTS A–D

AUTO ION SITE
KALAMAZOO, MICHIGAN

MS68403T
110293

Attachment 5: Inorganic Contaminant Results for 1988 Sediment Samples (page 1 of 2)

AUTO ION SITE
KALAMAZOO, MICHIGAN

TABLE 1-10

INORGANIC SEDIMENT RESULTS (mg/kg dry weight)

	UPSTREAM				ADJACENT					ADJACENT				IMMEDIATELY DOWNSTREAM				0.5 MILE DOWNSTREAM			1 MILE DOWNSTREAM		
	A1	A2	A3	A4	B1	B1-DUP	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3	D4	E2	E3	E4	F1	F2	F3
Aluminum	959	952	1,160	1,380	1,770	1,160	1,200	2,620	2,200	960	739	663	738	1,080	1,930	1,620	1,320	2,710	2,870	1,410	2,550	1,460	2,090
Antimony	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Arsenic	<2.0	<2.0	<2.0	2.0	<2.0	<2.0	<2.0	5.6	<2.0	<2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	9.0	5.9	3.2	6.5	2.8	<2.0
Barium	<40	<40	<40	<40	<40	<40	<40	62	<40	<40	<40	<40	<40	<40	<40	<40	95	65	<40	<40	<40	<40	<40
Beryllium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	2.0	3.8	<1.0	<1.0	<1.0
Calcium	47,600	23,900	29,400	42,800	39,700	30,700	46,000	81,700	45,600	37,500	82,100	37,100	40,300	26,900	62,400	68,500	35,100	24,600	51,000	46,700	23,600	29,600	35,600
Chromium (total)	17	19	19	16	19	18	17	23	24	19	13	12	18	17	16	23	113	27	31	26	54	22	23
Cobalt	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Copper	<5.0	<5.0	14	6	10	6.4	<5.0	14	11	<5.0	13	6.4	6.6	37	<5.0	<5.0	117	45	66	13	44	11	9.0
Cyanide	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron	3,670	3,810	4,340	5,780	14,900	6,560	4,980	13,200	19,100	6,190	4,750	4,160	5,910	4,970	5,580	7,730	11,100	16700	16,200	6,760	10,800	6,920	6,850
Lead	15	18	11	13	35	20	R	208	63	43	19	8	43	31	8.6	24	71	77	99	75	189	31	26
Magnesium	9,020	3,670	5,500	9,290	12,300	4,660	13,100	36,500	9,690	7,500	14,000	8,430	9,250	7,540	11,200	24,800	6,670	7,670	8,420	8,370	4,530	6,220	10,200
Manganese	207	259	256	192	249	189	268	294	282	177	243	131	203	189	205	274	173	415	228	140	336	172	142
Mercury	<0.1	<0.1	<0.1	<0.1	0.20	<0.1	0.10	<0.1	0.70	<0.1	<0.1	0.10	<0.1	2.9	0.20	0.20	<0.1	0.14	0.18	0.22	0.47	<0.1	<0.1
Nickel	<8.0	<8.0	16	<8.0	<8.0	<8.0	<8.0	12	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	18	19	17	14	12	<8.0	13
Potassium	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
Selenium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	<2.0	2.1	3.0	<2.0	<2.0	<2.0
Sodium	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
Thallium	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.5	<2.0	<2.0	<2.0	<2.0
Vanadium	<10	<10	<10	<10	<10	<10	<10	15	<10	<10	<10	<10	<10	<10	<10	<10	<10	14	<10	<10	<10	<10	<10
Zinc	31	38	32	23	52	46	25	82	74	56	27	17	51	53	26	44	81	70	82	43	160	39	37

R – Data Unusable

68403ITbl10

ATTACHMENT 6

EVALUATION OF ACL EXCEEDENCES
REMEDIAL ACTION PLAN
AUTO ION SITE

Occurrence of ACL exceedence			
][			
Have data been validated?	No	→	Conduct data validation
][Yes			
Are data valid?	No	→	Undertake corrective action (e.g., resample)
][Yes			
Conduct next round of sampling			
][			
Are data valid?	No	→	Undertake corrective action (e.g., resample)
][Yes			
Is initial ACL exceedence repeated?	No	→	Continue routine monitoring
][Yes			
Is exceedence higher than background?	No	→	Continue routine monitoring
][Yes			
Is the federal SWQC criterion, taking into consideration the mixing zone, exceeded?	No	→	Adjust ACL and continue routine monitoring
][Yes			
Increase sampling frequency to monthly for three months, and evaluate results to determine statistical significance			
][			
Is exceedence of SWQC confirmed?	No	→	Adjust ACL and continue routine monitoring
][Yes			
Conduct sampling program to evaluate impact to river			
][			
Is river being adversely impacted?	No	→	Adjust ACL and continue routine monitoring
][Yes			
Conduct evaluation of remedial action alternatives			

Attachment 6: Decision Flow Chart from Remedial Action Plan

ATTACHMENT 7

CONESTOGA-ROVERS
& ASSOCIATES

651 Colby Drive, Waterloo, Ontario, Canada N2V 1C2
Telephone: (519) 884-0510 Fax: (519) 884-0525
www.CRAworld.com

MEMORANDUM

TO:	Karen Partington, John Buyers	REF. NO.:	9182-02/pw/51 (AttA-9182Tierney-59)
FROM:	Daniela Araujo, Wesley Dyck	DATE:	March 10, 2005
RE:	**Evaluation of Chromium, Cyanide, and Nickel Data Above Final ACLs Auto Ion Site Kalamazoo, Michigan**		

1.0 INTRODUCTION

This memorandum presents an evaluation of groundwater monitoring data at the Auto Ion Site (Site) in Kalamazoo, Michigan. Specifically, concentrations greater than final Alternate Concentration Limits (ACLs) were evaluated for chromium in Point of Compliance (POC) monitoring wells MW-3B, MW-5C and MW-5D, for cyanide in POC monitoring well MW-5B, and for nickel in POC monitoring well MW-4B.

The evaluation was conducted because the final ACLs for chromium at wells MW-3B (11 µg/L), MW-5C (17 µg/L) and MW-5D (42.6 µg/L), for cyanide at well MW-5B (10 µg/L), and for nickel at well MW-4B (851 µg/L) were exceeded during two consecutive monitoring events: Round 23 (July 2004) and Round 24 (January 2005). The observed chromium concentrations were 25.9 µg/L in Round 23 and 10.7/18.7 µg/L (field duplicate results) at well MW-3B, 447 µg/L in Round 23 and 79.8 µg/L in Round 24 at well MW-5C, and 382 µg/L in Round 23 and 62.3 µg/L in Round 24 at well MW-5D. The observed cyanide concentrations at well MW-5B were 58.1 µg/L in Round 23 and 32.1 µg/L at well MW-5B in Round 24. The observed nickel concentrations at well MW-4B were 1120 µg/L in Round 23 and 944 µg/L in Round 24.

In this case, the action specified in the Contingency Plan/Remedial Action Plan (CP/RAP) (CRA, 1998) is to evaluate the results. The evaluation presented in this memorandum consisted of two steps. The first step was to use a statistical evaluation to compare the data from the POC wells to the background groundwater quality data to determine if the confirmed Round 24 ACL exceedances are due to background (upgradient) conditions. The statistical evaluations were performed using data collected during the last eight rounds of monitoring and are discussed in Section 2.0 below. The second step (where required) was to determine if the observed concentrations in the POC well would result in an exceedance of Federal surface water quality criteria with consideration for the mixing zone and is discussed in Section 3.0 below.

2.0 STATISTICAL EVALUATION

2.1 STATISTICAL METHOD

The parametric analysis of variance (ANOVA) is the statistical procedure specified in the CP/RAP to determine if a concentration value is due to background conditions. This procedure makes a number of assumptions about the design and implementation of the sampling program. Specifically, it is assumed that:

(i) the samples collected are representative of the material to be characterized;

(ii) a sufficient number of samples have been collected to represent the variability in sampling results (minimum of four samples); and

(iii) that samples have been collected using a random selection methodology.

The first assumption is met through the application of a quality assurance plan during sampling at the site. The second assumption is adhered to using eight samples for the statistical evaluation. The third assumption does not strictly apply for intra-well comparisons, since the location of sampling is fixed (i.e., the same well), as is the sampling frequency (e.g., semiannual).

In addition to the sampling design assumptions, two assumptions are made with regard to statistical properties of the monitoring data. These assumptions are:

(i) that the data are normally distributed, or are normally distributed using a data transformation; and

(ii) that the groups of data being compared (i.e., a background well against the exceeding monitoring well) have similar variances.

The validity of these latter two assumptions was assessed during the statistical analysis. A discussion of this is presented in Section 2.3.

For the purposes of the statistical evaluation, a value of one-half the detection limit was substituted for non-detected results.

2.2 DATA USED FOR ANALYSIS

As noted in Section 1.0, the eight most recent results from each well were used for the statistical analysis. For the comparison of chromium concentrations, since wells MW-3B, MW-5C, and MW-5D are deep monitoring wells, the background well MW-1B was used. For the comparison of cyanide concentrations, the background well MW-1A was used, since well MW-5B is a shallow monitoring well. For the comparison of nickel concentrations, the background well MW-1B was used, since well MW-4B is a deep monitoring well. The analytical data used for the statistical evaluation are presented in Table A-1 for chromium and in Table A-2 for nickel and cyanide.

2.3 ASSESSMENT OF ASSUMPTIONS

As introduced in Section 2.1, the ANOVA procedure makes assumptions of normality and equal variances for the data sets used. These assumptions were assessed separately for the chromium data at POC wells MW-3B, MW-5C, and MW-5D and background well MW-1B, the cyanide data at the POC well MW-5B and background well MW-1A, and the nickel data at the POC well MW-4B and background well MW-1B. Normality was tested for using probability plotting and the Shapiro-Wilk W-test. Homogeneity of variance was evaluated using Levene's test.

The chromium data at MW-1B and MW-3B were both found to be normally distributed. The homogeneity of variance assumption was verified using Levene's test. The parametric ANOVA was therefore performed using untransformed data.

The chromium data at MW-1B and MW-5C were both found to be normally distributed. However, the homogeneity of variance assumption was not met, as indicated by the results of Levene's test. The parametric ANOVA was performed using the untransformed data, noting the failure of statistical assumptions. To verify that the failure of statistical assumptions did not impact the validity of the statistical analysis, a second confirmatory procedure (non-parametric ANOVA) was employed, as described below.

The chromium data at MW-1B and MW-5D were both found to be lognormally distributed, and the homogeneity of variance assumption was verified using Levene's test on the log-transformed data. The parametric ANOVA was therefore performed using the log-transformed data.

The cyanide data at MW-1A were found to be neither normally nor lognormally distributed while data at POC well MW-5B were found to be normally distributed. The homogeneity of variance assumption was found to not be met using Levene's test. Due to lognormal distribution at MW-5B, the parametric ANOVA was performed using the log-transformed data, noting the failure of statistical assumptions. It is noted that the data distribution at MW-1A was influenced by a large proportion of non-detected values (100 percent non-detected values). To verify that the failure of statistical assumptions did not impact the validity of the statistical analysis, a second confirmatory procedure (non-parametric ANOVA) was employed, as described below.

The nickel data at MW-1B and MW-4B were both found to be lognormally distributed. However, the homogeneity of variance assumption was not met using Levene's test. The parametric ANOVA was performed using the log-transformed data, noting the failure of statistical assumptions. To verify that the failure of statistical assumptions did not impact the validity of the statistical analysis, a second confirmatory procedure (non-parametric ANOVA) was employed, as described below.

The parametric ANOVA procedure specified in the CP/RAP is one of four statistical methodologies listed in 40 CFR 264.97(h). Under this regulation, a non-parametric ANOVA is also permitted [40 CFR 264.97(h)(2)]. The non-parametric method makes no distributional assumptions regarding the data sets, and therefore is appropriate for statistical analyses of data that are not normally distributed. The non-parametric ANOVA was therefore applied to data at wells for which violations in statistical assumptions were noted (chromium at MW-5C vs. MW-1B, cyanide at MW-5B vs. MW-1A, and nickel at MW-4B vs. MW-1B) to confirm the findings of the original (parametric) ANOVA procedure.

2.4 RESULTS FROM ANOVA EVALUATIONS

The raw statistical outputs from the ANOVA evaluations are presented in Attachments A-1 to A-8.

Considering the chromium result at MW-3B, the parametric (P=0.987) ANOVA did not find a statistically significant difference in the mean chromium concentration compared to background well MW-1B. Thus, the concentration of chromium at MW-3B above the final ACL is attributed to background conditions as represented by the result for MW-1B, and given this determination no further analysis is required.

For chromium at POC well MW-5C, both the parametric (P=0.021) and non-parametric (P=0.012) ANOVAs did find an elevation in concentration at MW-5C compared to background well MW-1B. Thus, the concentration of chromium at MW-5C above the final ACL cannot be attributed to background conditions as represented by the result for MW-1B. Given this determination, the next step was to evaluate if the Round 24 concentration results in an exceedance of Federal surface water quality criteria with consideration for the mixing zone. This is discussed in Section 3.0 below.

Considering the chromium result at POC well MW-5D, the parametric (P=0.590) ANOVA did not find a statistically significant difference in the mean chromium concentration compared to background well MW-1B. Thus, the concentration of chromium at MW-5D above the final ACL is attributed to background conditions as represented by the result for MW-1B, and given this determination no further analysis is required.

For the cyanide result at POC well MW-5B, both parametric (P=4.69E-05) and non-parametric (P= 3.3E-04) ANOVAs found a statistically significant difference compared to upgradient well MW-1A. Thus, the concentration of cyanide at MW-5B above the final ACL cannot be attributed to background conditions as represented by the result for MW-1A. Given this determination, the next step was to evaluate if the Round 24 concentration also results in an exceedance of Federal surface water quality criteria with consideration for the mixing zone. This is discussed in Section 3.0 below.

Finally, considering the nickel result at POC well MW-4B, both the parametric (P= 5.5E-07) and the non-parametric (P=0.001) ANOVAs found a statistically significant elevation in nickel concentration compared to background well MW-1B. Thus, the concentration of nickel at MW-4B above the final ACL cannot be attributed to background conditions as represented by the result for MW-1B. Given this determination, the next step was to evaluate if the Round 24 concentration results in an exceedance of Federal surface water quality criteria with consideration for the mixing zone. This is discussed in Section 3.0 below.

3.0 COMPARISON OF DATA TO FEDERAL SURFACE WATER QUALITY CRITERIA WITH CONSIDERATION FOR THE MIXING ZONE

If it is determined by the statistical evaluation that a result may not be due to background conditions, then the next step specified by the CP/RAP is to compare the measured concentrations to Federal surface water quality criteria, with consideration for the mixing zone. The procedure used to make such a determination is described in Section 2.3 and Appendix B of the CP/RAP. The procedure includes the following two steps:

1. Determination of the use classification of the receiving water body and identify numeric water quality criteria (chemical-specific); and
2. Determination of the reasonable potential to exceed applicable criteria.

These steps were explored at the time of RD Work Plan development.

With regard to Step 1, applicable water quality criteria (U.S. EPA, 2002) for calculating freshwater metals criteria that are hardness-dependant are as follows:

- Fresh water protection (acute) = EXP (m_A * Ln(H) + b_A)* (CF);
- Fresh water protection (chronic) = EXP (m_C * Ln(H) + b_C)* (CF); and
- Human health (fish ingestion) = not established.

In the above equations, m_A, b_A, m_C, and b_C are parameter-specific and are listed in Appendix B Table in the National Recommended Water Quality Criteria (U.S. EPA, 2002). The CF value is 1.0 because total metal samples (not dissolved metals) were collected in the field. H refers to hardness (mg/L as $CaCO_3$) in the water column. A hardness value of 250 mg/L, which was provided by MDEQ, was specified in the RD Work Plan. Substituting the hardness value into the above equations gives:

For chromium:

- Fresh water protection (acute) = EXP (0.8190 * Ln(250) + 3.7256)* (1) = 3819 µg/L;
- Fresh water protection (chronic) = EXP (0.8190 * Ln(250) + 0.6848)* (1) = 183 µg/L; and
- Human health (fish ingestion) = not established.

For nickel:

- Fresh water protection (acute) = EXP (0.8460 * Ln(250) + 20255)* (1) = 1019 µg/L;
- Fresh water protection (chronic) = EXP (0.8460 * Ln(250) + 0.0584)* (1) = 113 µg/L; and
- Human health (fish ingestion) = not established.

Applicable water quality criteria [as discussed in "National Recommended Water Quality Criteria", USEPA, November 2002 (EPA 822-R-02-047)] for free cyanide (as CN) are as follows (in µg/L):

- Fresh water protection (acute) = 22
- Fresh water protection (chronic) = 5.2
- Human health (water + fish ingestion) = 700; and
- Human health (fish ingestion only) = 220,000

With regard to Step 2, the determination as to the reasonable potential to exceed applicable criteria is made by modeling the effect of the mixing zone. This modeling makes use of known flow values for the segment of the receiving water body in question. Flow values for the section of the Kalamazoo River adjacent to the

Auto Ion Site were obtained at the time of RD Work Plan development. These values were confirmed in conversations with MDEQ personnel in August 2000, and form the basis of the present calculations. Consideration for the mixing zone is incorporated into the comparison by using the flow values to project the concentration of chemicals contained in the effluent (site groundwater that vents to the Kalamazoo River) as it enters the receiving water body. These projected concentrations are then compared to the applicable water quality criteria. The CP/RAP simplifies the modeling process using the following equation:

$$[C_r]=\frac{Q_d*[C_d]}{Q_s}$$

Where (values shown were obtained from the RD Work Plan):

C_r = resultant in-stream chemical concentration in the stream reach (after complete mixing occurs);
Q_d = effluent flow;
C_d = chemical concentration in effluent (i.e., chromium, cyanide, or nickel concentration); and
Q_s = background stream flow (1Q10 = 230 ft^3/s for acute toxicity; 7Q10 = 280 ft^3/s for chronic toxicity).

The effluent flow (Q_d) was calculated using Darcy's Law, as discussed in Appendix B of the CP/RAP. Darcy's Law estimates groundwater discharges using hydraulic conductivity (K), hydraulic gradient (i), and the cross-sectional area of discharge (A). Values for K, i, and A were provided in the CP/RAP. An updated value for i is used herein, based on updated hydraulic gradient data. The hydraulic gradient value used was obtained by determining the average hydraulic gradient observed during all hydraulic monitoring events during Round 24 in which a gradient toward the river was observed. The average hydraulic gradient was determined to be 0.002533 ft/ft. Substituting this value for i into the Darcy equation, along with values for K of 3.806×10^{-4} ft/s and A of 27,000 ft^2, as established in the CP/RAP, gives:

$$\begin{aligned} Q_d &= KiA \\ &= 3.806 \times 10^{-4} \times 0.002533 \times 27000 \\ &= 0.02603\ ft^3/s \end{aligned}$$

Thus, $Q_d = 0.02603\ ft^3/s$.

The modeling process evaluated two scenarios for projected chromium, cyanide, and nickel concentrations at the Kalamazoo River. These values represent:

i) an average value (based on an average value calculated for the POC wells during the monitoring event); and

ii) a worst-case value (based on the maximum detected value in the POC wells during the monitoring event).

Chromium, cyanide, and nickel data for the eight POC wells during Round 24 are presented in Table A-3. The average chromium concentration calculated was 27.8 μg/L (based on detections in 5 out of 8 POC wells, and a conservative assumption that chromium was present at the detection limit at the 3 POC wells where chromium was reported as not detected). The average cyanide concentration calculated was 12.8 μg/L (based on a detection in 1 out of 8 POC wells, and a conservative assumption that cyanide was present at the detection limit at the 7 POC wells where cyanide was reported as not detected). The average nickel concentration calculated was 1767 µg/L (based on detections in 6 out of 8 POC wells, and a conservative assumption that nickel was present at the detection limit at the 2 POC wells where nickel was reported as not detected). Note that where duplicate results were obtained the highest value between the investigative sample and the duplicate was (conservatively) used. The worst-case value for chromium was found to be 79.8 µg/L based on the observed chromium concentration at MW-5C, for cyanide was 32.1 µg/L based on the observed cyanide concentration at MW-5B, and for nickel was 8,440 µg/L based on the observed nickel concentration at MW-5D during the twenty-fourth monitoring event. These values were modeled and compared to the applicable criteria, as follows:

Category	*Criterion (µg/L)*	*Modeled Chromium Concentration at River*	
		Average Scenario (µg/L)	*Worst Case Scenario (µg/L)*
Acute	3819	0.00315	0.00903
Chronic	183	0.00258	0.00742
Human Health (fish ingestion)	N/A	Not Applicable	Not Applicable

Category	*Criterion (µg/L)*	*Modeled Cyanide Concentration at River*	
		Average Scenario (µg/L)	*Worst Case Scenario (µg/L)*
Acute	22	0.00144	0.00363
Chronic	5.2	0.00119	0.00298
Human Health (fish ingestion)	220,000	Not Applicable	Not Applicable

Category	*Criterion (µg/L)*	*Modeled Nickel Concentration at River*	
		Average Scenario (µg/L)	*Worst Case Scenario (µg/L)*
Acute	1019	0.200	0.955
Chronic	113	0.1643	0.784
Human Health (fish ingestion)	N/A	Not Applicable	Not Applicable

Thus, the modeled concentrations indicate that there is no reasonable potential to exceed the applicable Federal surface water quality criteria. Also, according to the CP/RAP, the ACL may be adjusted in the case where a result is not attributable to background and would not result in an exceedance of Federal surface water quality criteria.

4.0 CONCLUSIONS

The results of the statistical evaluation of the chromium analytical data at POC wells MW-3B and MW-5D, which were greater than final ACLs, are attributable to background conditions. As specified in the preliminary ACLs report (CRA, 2000), routine groundwater monitoring may resume and the ACLs for chromium at MW-3B and MW-5D may be adjusted.

The results of the statistical evaluations of the analytical data for chromium at POC well MW-5C, for cyanide at POC well MW-5B, and for nickel at POC well MW-4B show that the concentrations above the final ACLs may not be attributable to background conditions. However, modeling of the resultant river concentrations of chromium, cyanide, and nickel considering the groundwater mixing zone between the POC wells and the Kalamazoo River demonstrated that there is no reasonable potential to exceed applicable Federal surface water quality criteria. As specified in the preliminary ACL report (CRA, 2000), routine groundwater monitoring may resume and the ACLs for chromium at MW-5C, cyanide at MW-5B, and nickel at MW-4B may be adjusted.

5.0 REFERENCES

Conestoga-Rovers & Associates, July 1998. "Remedial Design (RD) Work Plan for Operable Unit 2", Auto Ion Site, Kalamazoo, Michigan.

U.S. EPA, November 2002. National Recommended Water Quality Criteria: 2002. Office of Water and Office of Science and Technology. United States Environmental Protection Agency, Washington D.C. (EPA 822-R-02-047)

ATTACHMENT 8

AUTO ION SITE
KALAMAZOO, MICHIGAN

TABLE 4-1

EXCAVATION AND DISPOSAL SUMMARY (Tons)

	HR/E			CET			
Material	Exterior to Basement	Interior to Basement	Subtotal	Interior to Basement	Site Scraping	Subtotal	Total HR/E & CET Combined
Non Hazardous Soil/Debris	4,951	482	5433	3,996	2,421	6,417	11,850
F006 Soil	10,051	0	10,051	326 (a)	0	326	10,377
F006 Debris	348	335	683	1,334 (b)	0	1,334	2,016

684011EXDIS

eder associates consulting engineers, p.c.

Attachment 8: Volume of Soil Excavated during OU1
Auto Ion Five-Year Review
September 2006

ATTACHMENT 9

AUTO ION SITE
KALAMAZOO, MICHIGAN

TABLE 2-1

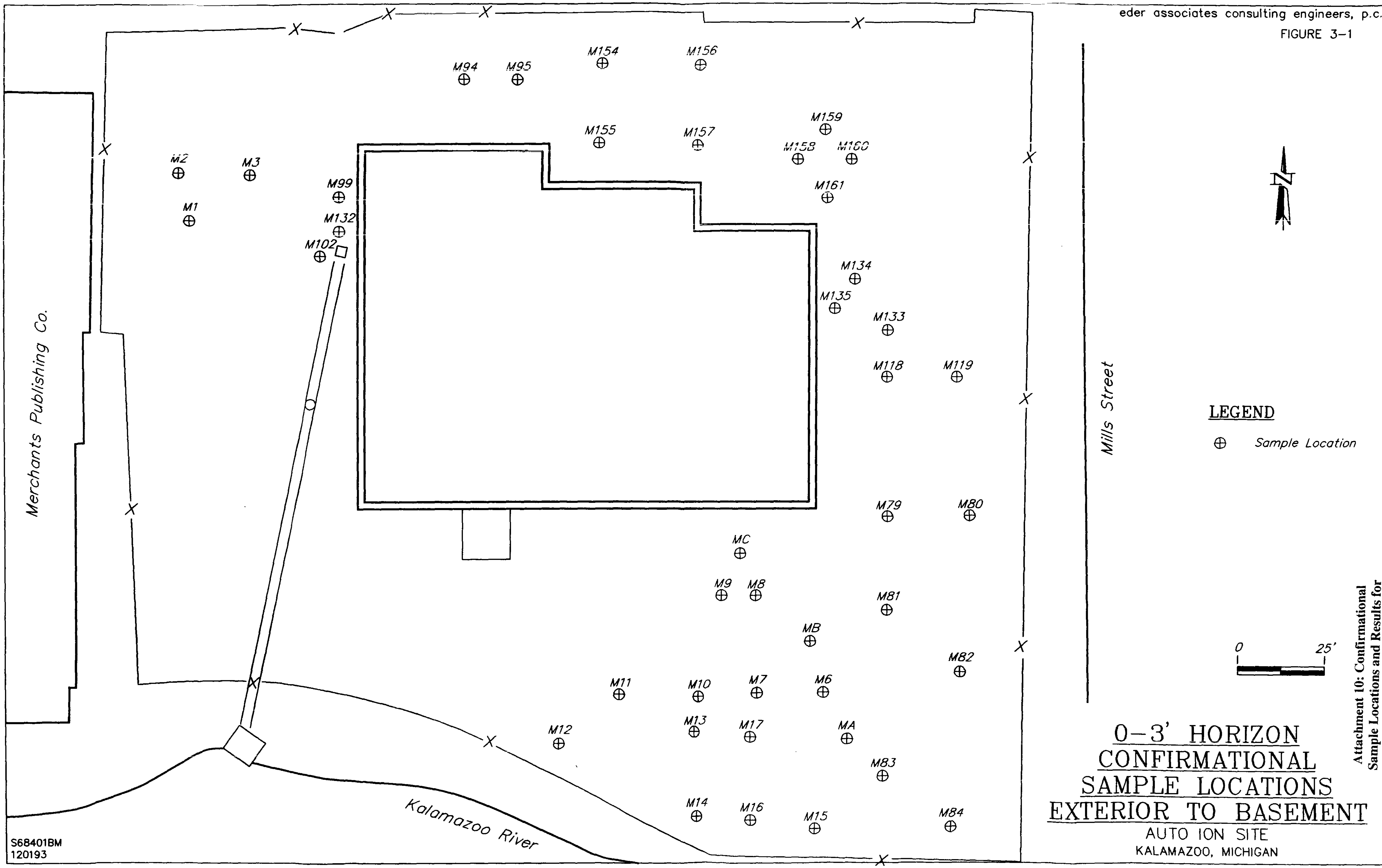
CLEANUP CRITERIA (mg/kg)

	x	s	Background (x+2s)	Risk Assessment	Site-Specific Cleanup Levels
Arsenic	5.18	4.44	14.1	1.4	14.1
Cadmium	6.13	32.9	71.8		2.45
	0.7071	0.87	2.45		
Chromium	10.7	6.35	23.4	84,700	84,700
Lead	91.1	382	855	119	119
	23.7	33.2	90.1		
Nickel	9.69	11.9	33.6	149	149
	7.93	5.40	18.7		
PAHs				0.0608	
				13.8	13.8

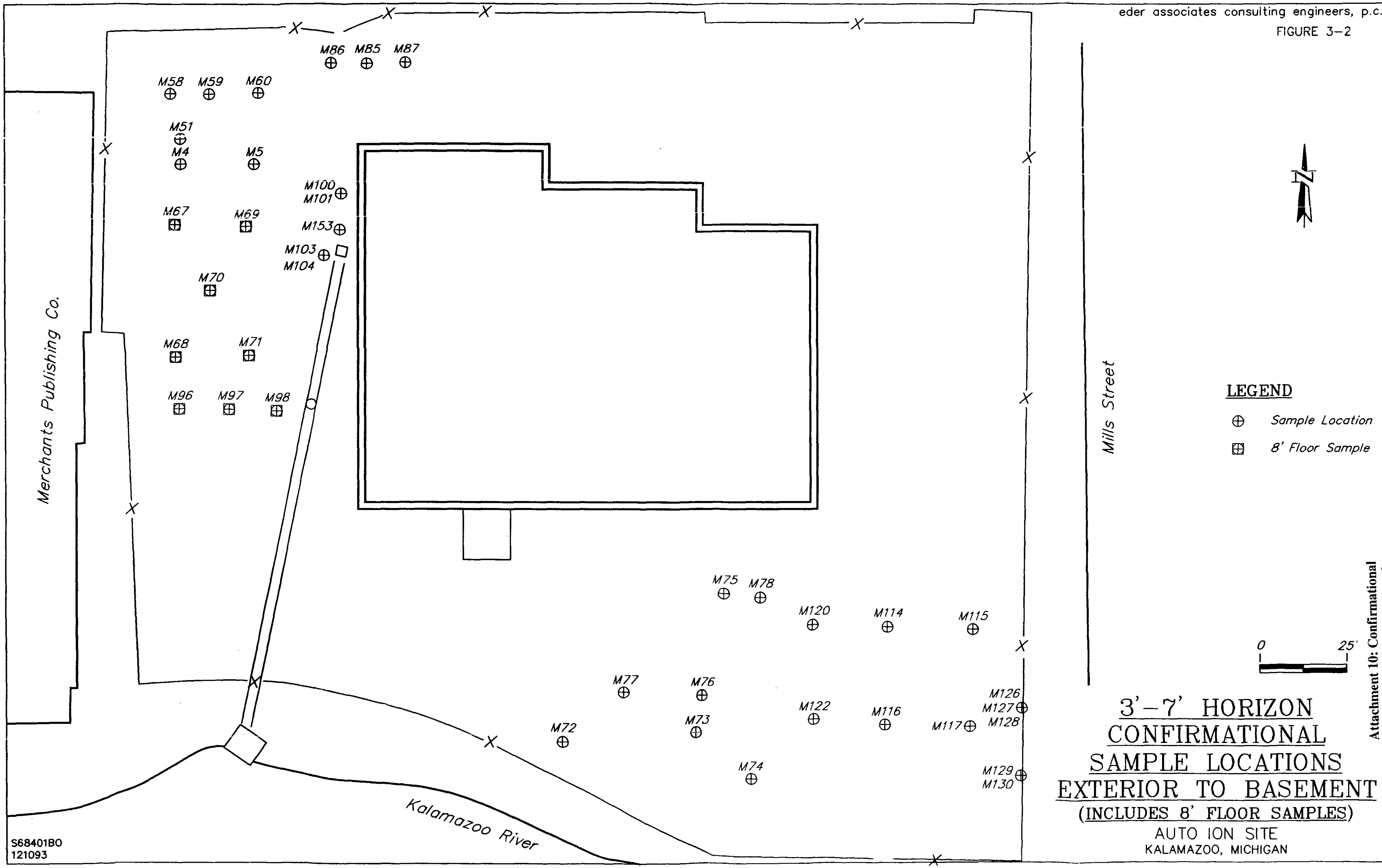
☐ Revised Levels

684011\TBL2-1

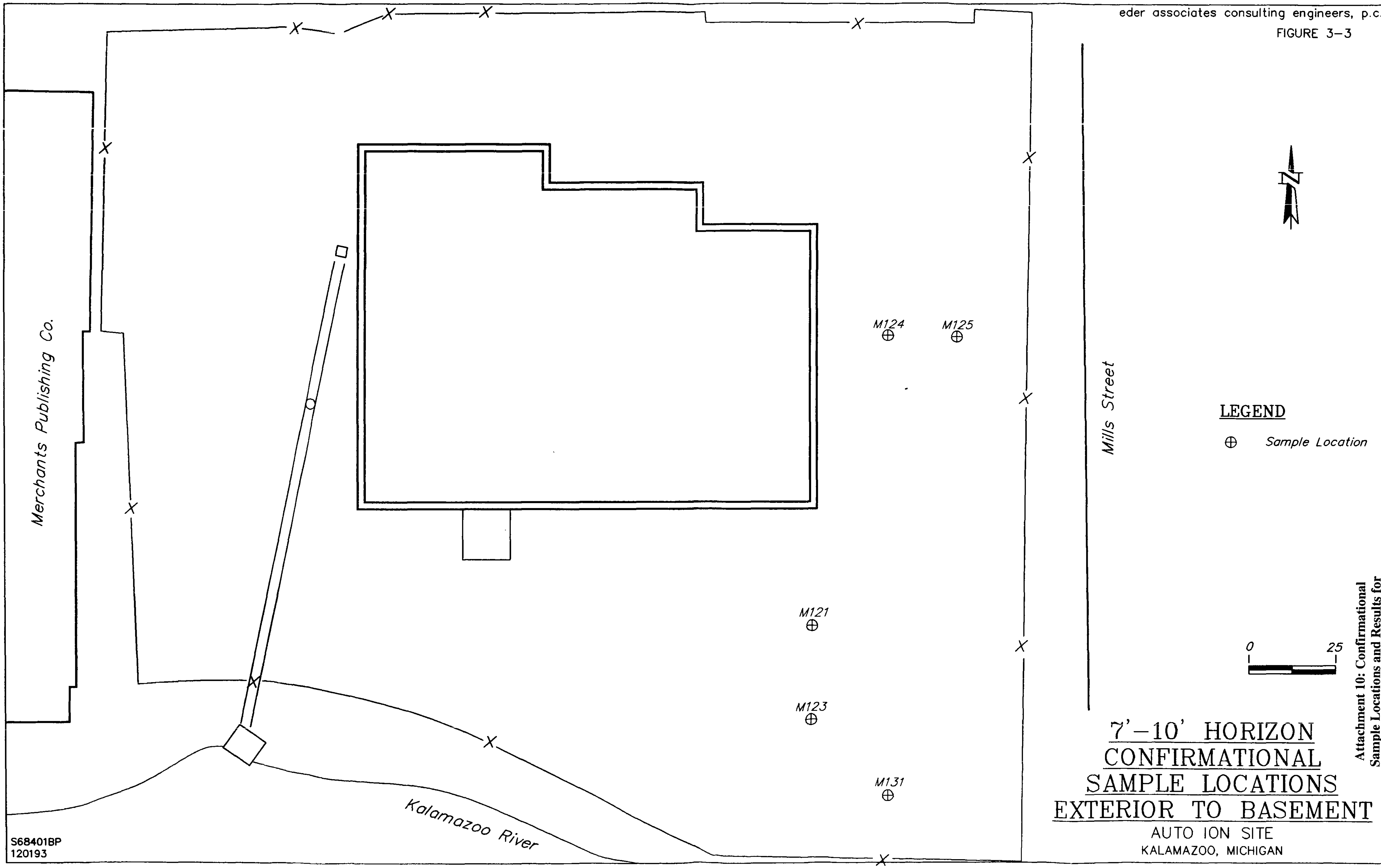
ATTACHMENT 10



Attachment 10: Confirmational Sample Locations and Results for Soil Excavation (page 1 of 10)
Auto Ion Five-Year Review
September 2006



Attachment 10: Confirmational Sample Locations and Results for Soil Excavation (page 2 of 10)
Auto Ion Five-Year Review
September 2006



7'–10' HORIZON CONFIRMATIONAL SAMPLE LOCATIONS EXTERIOR TO BASEMENT

AUTO ION SITE
KALAMAZOO, MICHIGAN

Attachment 10: Confirmational Sample Locations and Results for Soil Excavation (page 3 of 10)

0-3' HORIZON CONFIRMATIONAL SAMPLING ANALYTICAL SUMMARY (mg/kg)

(SAMPLES COLLECTED EXTERIOR TO THE BASEMENT)

AUTO ION SITE
KALAMAZOO, MICHIGAN

LABORATORY SAMPLE IDENTIFICATION		EDER SAMPLE IDENTIFICATION	Arsenic	Cadmium	Chromium	Lead	Nickel	Napthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene Chrysene	Benzo(b)fluoranthene Benzo(k)fluoranthene	Benzo(a)pyrene	Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	Benzo(g,h,i)perylene
Metals	PAH																		
MA		SDWL-35'	15.5	ND	242	54	42.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB		SDWL-70'	4.1	ND	15.5	16.2	10.3	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND
MC		SDWL-105'	54.8	ND	819	104	495	ND	1.2	ND	ND	3.7	9.9	9.2	8.9	5.0	7.2	3.2	2.8
M1		SDWL-25'	84	6	860	200	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M2		SDWL-21' - 0-3'	2.4	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M3		SDWL-42' - 0-3'	42	ND	810	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M6		BTS-1A-3'	20	1.8	270	58	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M7		BTS-1B-3'	20	2.3	230	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M8		BTS-1C-3'	38	2.8	170	150	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M9		BTS-2A-3'	36	2.8	340	69	240	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M10		BTS-2B-3'	7.4	2.8	47	160	26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M11		BTS-2C-3'	280	7.4	210	220	280	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M12		BTS-3A-3'	50	21	3,000	400	870	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M13		BTS-3B-3'	45	3.3	910	490	220	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M14		BTS-3C-3'	28	2.8	320	58	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M15		BTS-4A-3'	25	1.8	230	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M16		BTS-4B-3'	18	3.1	640	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M17		BTS-4C-3'	28	3.3	360	78	71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M79	P9	BTS-Q3'-1	9.1	ND	ND	ND	ND	ND	ND	ND	ND	1.5	1.1	3.2	1.6	4.5	ND	ND	ND
M80	P10	BTS-R3'-1	8.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND
M81	P11	BTS-W3'-1	12	ND	170	68	82	ND	ND	ND	ND	ND	2.4	4.2	4.7	6.6	2.6	2.9	ND
M82	P12	BTS-X3'-1	12	ND	75	80	ND	ND	ND	ND	ND	ND	ND	2.0	ND	4.4	ND	ND	ND
M83	P13	BTS-Z3'-1	1.7	ND	94	280	ND	ND	ND	ND	ND	1.8	3.5	2.6	3.6	ND	ND	ND	ND
M84	P14	BTS-BB3'-1	41	ND	840	ND	ND	ND	ND	ND	ND	ND	2.0	1.3	1.8	ND	ND	ND	ND

NA – Not Analyzed
ND – Not Detected
BOLD – Concentration Exceeded Site-Specific Cleanup Criteria
SDWL – Sidewall Sample
BTS – Floor Sample

(continued)

MS68404D
091693

(continued)

0-3' HORIZON CONFIRMATIONAL SAMPLING ANALYTICAL SUMMARY (mg/kg)

(SAMPLES COLLECTED EXTERIOR TO THE BASEMENT)

AUTO ION SITE
KALAMAZOO, MICHIGAN

LABORATORY SAMPLE IDENTIFICATION		EDER SAMPLE IDENTIFICATION	Arsenic	Cadmium	Chromium	Lead	Nickel	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene Chrysene	Benzo(b)fluoranthene Benzo(k)fluoranthene	Benzo(a)pyrene	Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	Benzo(g,h,i)perylene
Metals	PAH																		
M94	P18	BTS-C3'-1	6.1	5.5	190	36	39	ND	ND	ND	ND	ND	ND	2.2	ND	3.9	ND	ND	ND
M95	P19	BTS-C3'-2	4.0	ND	ND	ND	ND	ND	ND	ND	3.9	ND	ND	ND	ND	ND	ND	ND	ND
M99	P23	SDWL-H1.5'-1	8.6	ND	ND	ND	160	ND	ND	ND	ND	ND	2.7	ND	1.8	ND	ND	ND	ND
M102	P26	SDWL-H1.5'-2	14	ND	ND	ND	310	ND	ND	ND	ND	ND	3.0	ND	1.9	ND	ND	ND	ND
M118	P33	SDWL-K1.5'	6.6	2.8	ND	ND	ND	ND	ND	ND	1.6	16.5	11	10	12.9	8.1	5.6	5	2
M119	P34	SDWL-L1.5'	6.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	ND
M132	P47	BTS-H3'-1	12	ND	ND	ND	180	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M133	P48	SDWL-K1.5'-1	11	ND	ND	ND	ND	ND	ND	ND	ND	1.2	1.6	ND	1.4	ND	ND	ND	ND
M134	P49	SDWL-K1.5'-2	7.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND
M135	P50	BTS-K3'-1	9.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4	ND	1.7	ND	ND	ND	ND
M154	P52	BTS-D3'-1	8.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	ND	2.0	ND	ND	ND	ND
M155	P53	BTS-D3'-2	5.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.1	ND	2.1	ND	ND	ND	ND
M156	P54	BTS-D3'-3	6.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.0	1.1	2.8	ND	ND	ND	ND
M157	P55	BTS-D3'-4	8.8	ND	57	ND	ND	ND	ND	ND	ND	ND	3.9	1.2	3.3	ND	ND	ND	ND
M158	P56	SDWL-E1.5'-1	4.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.6	ND	2.8	ND	ND	ND	ND
M159	P57	TP-N	12	ND	ND	ND	56	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND
M160	P58	TP-E	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.8	1.4	3.0	ND	ND	ND	ND
M161	P59	TP-S	6.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5	ND	1.0	ND	ND	ND	ND

NA – Not Analyzed
ND – Not Detected
BOLD – Concentration Exceeded Site-Specific Cleanup Criteria
SDWL – Sidewall Sample
BTS – Floor Sample

MS68404E
091693

3'-7' HORIZON CONFIRMATIONAL SAMPLING ANALYTICAL SUMMARY (mg/kg)

(SAMPLES COLLECTED EXTERIOR TO THE BASEMENT)

AUTO ION SITE
KALAMAZOO, MICHIGAN

LABORATORY SAMPLE IDENTIFICATION		EDER SAMPLE IDENTIFICATION	Arsenic	Cadmium	Chromium	Lead	Nickel	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene Chrysene	Benzo(b)fluoranthene Benzo(k)fluoranthene	Benzo(a)pyrene	Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	Benzo(g,h,i)perylene
Metals	PAH																		
M4		SDWL-21' 3'-8'	2	1.3	320	ND	170	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M5		SDWL-42' 3'-8'	8	1.8	250	ND	56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M51		SDWL-12' 3'-8'	21	1.3	460	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M58	P1	BTS-NW7'-1 17'	8.8	ND	350	ND	ND	ND	160	150	23	1.5	2.9	4.0	1.1	ND	ND	ND	ND
M59	P2	BTS-MW7'-2 28'	19	ND	340	ND	ND	ND	11.2	9.4	1.4	ND	ND	ND	ND	ND	ND	ND	ND
M60	P3	BTS-NW7'-3 43'	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M67	P4	BTS-G8'-1	5.4	1.7	ND	ND	200	ND	ND	ND	ND	ND	2.0	ND	1.5	ND	ND	ND	ND
M68	P5	BTS-G8'-2	5.8	ND	660	ND	320	4.5	107	76	34	4.5	4.1	3.9	5.2	ND	ND	ND	ND
M69	P6	BTS-H8'-1	24	1.1	3,400	ND	530	ND	55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M70	P7	BTS-H8'-2	14	ND	1,100	ND	270	2.6	ND	ND	ND	5.5	4.9	4.1	3.2	ND	ND	ND	ND
M71	P8	BTS-H8'-3	23	ND	620	ND	210	ND	6	2.2	ND	ND	1.9	ND	2.8	ND	ND	ND	ND
M72		BTS-Y5'-1	28	1.2	240	78	220	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M73		BTS-Y5'-2	2.3	1.4	350	760	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M74		BTS-Z5'-1	14	ND	160	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M75		BTS-V5'-1	22	ND	2,300	150	2,300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M76		BTS-V5'-2	9.1	ND	420	ND	60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M77		BTS-V5'-3	16	ND	420	210	280	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M78		BTS-W5'-1	12	ND	52	ND	85	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M85	P15	BTS-B7'-1 11'	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.0	ND	2.2	ND	ND	ND	ND
M86	P16	BTS-B7'-2 22'	9.3	ND	ND	ND	64	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M87	P17	SDWL-C7'-1	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M96	P20	BTS-M8'-1	5.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M97	P21	BTS-N8'-1	5.0	ND	ND	ND	120	ND	ND	ND	ND	10	17	14	18	ND	ND	ND	ND
M98	P22	BTS-N8'-2	5.9	ND	ND	ND	170	ND	ND	ND	2.8	1.0	3.3	ND	ND	ND	ND	ND	ND

(continued)

NA – Not Analyzed
ND – Not Detected
BOLD – Concentration Exceeded Site-Specific Cleanup Criteria
SDWL – Sidewall Sample
BTS – Floor Sample

MS68404F
091793

(continued)

3'-7' HORIZON CONFIRMATIONAL SAMPLING ANALYTICAL SUMMARY (mg/kg)

(SAMPLES COLLECTED EXTERIOR TO THE BASEMENT)
AUTO ION SITE
KALAMAZOO, MICHIGAN

LABORATORY SAMPLE IDENTIFICATION		EDER SAMPLE IDENTIFICATION	Arsenic	Cadmium	Chromium	Lead	Nickel	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene Chrysene	Benzo(b)fluoranthene Benzo(k)fluoranthene	Benzo(a)pyrene	Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	Benzo(g,h,i)perylene
Metals	PAH																		
M100	P24	SDWL-H5'-1	8.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M101	P25	SDWL-H7.5'-1	8.6	ND	170	ND	ND	ND	ND	ND	ND	ND	2.0	ND	1.2	ND	ND	ND	ND
M103	P27	SDWL-H5'-2	2.1	ND	ND	ND	ND	ND	2.3	1.4	ND	ND	4.4	1.9	ND	ND	ND	ND	ND
M104	P28	SDWL-H7.5'-2	4.7	ND	80	ND	ND	ND	4.1	11	3.2	2.9	1.4	2.3	1.2	ND	ND	ND	ND
M114	P29	BTS-W5'-1	7.8	ND	85	73	86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M115	P30	BTS-X5'-1	7.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M116	P31	BTS-Z5'-1	7.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7	1.4	1.8	ND	ND	ND	ND
M117	P32	BTS-BB5'-1	8.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M120	P35	SDWL-W6'-1	12	ND	180	ND	180	ND	69	29	ND	14	34	83	109	13	ND	ND	ND
M122	P37	SDWL-Z6'-1	4.0	ND	64	ND	ND	ND	ND	ND	ND	ND	2.9	ND	1.8	ND	ND	ND	ND
M126	P41	SDWL-E1	7.3	ND	ND	ND	ND	ND	ND	ND	ND	1.2	2.4	1.9	2.7	ND	ND	ND	ND
M127	P42	SDWL-E2	6.4	1.6	ND	ND	71	ND	ND	ND	ND	1.2	2.6	ND	1.7	ND	ND	ND	ND
M128	P43	SDWL-E3	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	1.2	ND	ND	ND
M129	P44	SDWL-E4	11	ND	ND	ND	ND	ND	ND	ND	ND	1.4	3.6	2.2	2.5	ND	ND	9.0	ND
M130	P45	SDWL-E5	4.7	ND	87	ND	ND	ND	ND	ND	ND	ND	1.8	ND	1.2	ND	ND	7.3	11
M135	P51	BTS-H6'-1	9.4	ND	ND	ND	67	25	ND	11	18	140	82	7	83	58	33	ND	15

NA - Not Analyzed
ND - Not Detected
BOLD - Concentration Exceeded Site-Specific Cleanup Criteria
SDWL - Sidewall Sample
BTS - Floor Sample

MS68404G
091693

Attachment 10: Confirmational Sample Locations and Results for Soil Excavation (page 7 of 10)

7'-10' HORIZON CONFIRMATIONAL SAMPLING ANALYTICAL SUMMARY (mg/kg)

(SAMPLES COLLECTED EXTERIOR TO THE BASEMENT)

AUTO ION SITE

KALAMAZOO, MICHIGAN

LABORATORY SAMPLE IDENTIFICATION		EDER SAMPLE IDENTIFICATION	Arsenic	Cadmium	Chromium	Lead	Nickel	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene Chrysene	Benzo(b)fluoranthene Benzo(k)fluoranthene	Benzo(a)pyrene	Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	Benzo(g,h,i)perylene
Metals	PAH																		
M121	P36	SDWL-W8.5'-2	2	ND	83	ND	ND	ND	ND	ND	ND	ND	3	ND	2	ND	ND	ND	ND
M123	P38	SDWL-Z8.5'-2	6.8	ND	7,200	260	3,100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
M124	P39	SDWL-K8.5'-1	ND	ND	540	110	ND	ND	2.4	ND	ND	ND	6.1	6.4	ND	ND	ND	ND	ND
M125	P40	SDWL-L8.5'-1	5.6	ND	1,000	ND	140	ND	4.3	3.4	3.2	9.7	2.4	ND	ND	ND	ND	ND	ND
M131	P46	SDWL-Z8.5'-1	3.3	ND	85	ND	140	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NA – Not Analyzed
ND – Not Detected
BOLD – Concentration Exceeded Site-Specific Cleanup Criteria
SDWL – Sidewall Sample
BTS – Floor Sample

MS68404H
091693

CONFIRMATIONAL SAMPLING ANALYTICAL SUMMARY (mg/kg)

(SAMPLES COLLECTED INTERIOR TO BASEMENT - AUGUST-SEPTEMBER 1993)

AUTO ION SITE
KALAMAZOO, MICHIGAN

DESIGNATED SAMPLE IDENTIFICATION	EDER SAMPLE IDENTIFICATION	Arsenic	Cadmium	Chromium	Lead	Nickel	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Benzo(a)pyrene	Chrysene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	Dibenzo(a,h)anthracene
MP-1	B-13-SDWL-1 0-3'	7.2	ND	14.1	26.5	12.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MP-2	B-13-SDWL-2 0-3'	8.3	ND	229	35.4	93.2	ND	ND	1.4	4.6	7.3	ND	1.4	5.2	5.3	5.6	ND	1.7	ND	4.7	5.5	2.4
MP-3	B-13-FLR 0-3'	9.0	ND	74.4	39.1	33.1	ND	ND	ND	2.4	3.2	ND	ND	2.0	2.8	2.5	ND	ND	ND	2.0	2.5	ND
MP-4	B-19-SDWL-1 0-3'	4.6	ND	45.9	139	20.4	ND	ND	11	27	41	ND	13	23	35	62	4.8	5.2	3.1	49	57	16
MP-5	B-19-SDWL-2 0-3'	7.0	ND	65.1	73.2	23.0	ND	ND	4.0	11	16	ND	5.4	8.9	15	24	1.8	2.4	1.0	18	23	7.0
MP-6	B-19-SDWL-1 3'-7'	2.2	ND	18.5	11.0	11.0	ND	ND	2.4	6.4	8.4	ND	3.0	4.6	8.1	12	1.1	1.4	ND	9.9	11	3.7
MP-7	B-19-SDWL-2 3'-7'	4.7	1.6	100	42.4	21.8	ND	ND	99	230	340	ND	120	200	290	600	49	45	37	570	700	ND
MP-8	B-19-FLR 7'	7.0	ND	43.8	45.5	29.5	ND	ND	120	270	390	ND	130	230	340	700	57	57	33	680	840	170
MP-9	B-20-SDWL-1 0-3'	11.6	1.2	60.6	52.1	32.7	ND	ND	1.0	3.8	3.9	ND	1.4	1.6	4.4	4.7	ND	ND	ND	3.4	4.6	1.3
MP-10	B-20-SDWL-1 3'-7'	7.9	ND	65.9	51.9	30.7	ND	ND	ND	4.4	6.4	ND	1.2	3.8	5.2	4.7	ND	ND	ND	4.0	4.7	1.0
MP-11	B-20-SDWL-2 0-3'	6.6	ND	54.5	34.0	23.9	ND	ND	1.1	3.8	4.5	ND	ND	2.2	4.2	4.5	ND	ND	ND	3.6	4.6	ND
MP-12	B-20-SDWL-2 3'-7'	6.6	1.7	71.2	78.1	37.7	ND	ND	2.0	5.9	6.8	ND	1.7	3.3	7.2	9.4	1.0	ND	ND	7.2	9.0	ND
MP-13	B-20-FLR 7'	9.6	ND	263	61.9	85.8	ND	2.9	3.6	30	12	ND	2.1	12	ND	15	3.0	2.0	1.6	11	13	ND
MP-14	TP-1 0-3'	6.7	ND	19.6	34.4	13.7	ND	ND	1.9	2.8	4.9	ND	ND	3.0	4.1	5.3	1.4	ND	ND	6.0	4.8	ND
MP-15	TP-1 3'-7'	13.0	7.3	188	63.2	93.1	ND	1.3	16	13	23	ND	5.7	14	22	33	10	2.6	11	44	31	6.7
MP-16	TP-1 7'-BTM	8.5	ND	104	40.9	51.3	ND	ND	8.4	11	9.9	8.5	3.5	11	16	23	49	1.6	3.5	25	21	4.1
MP-17	TP-2 0-3'	2.9	ND	12.0	ND	5.8	ND	ND	ND	1.9	4.0	ND	1.2	2.3	3.2	4.1	ND	ND	ND	3.9	3.8	ND
MP-18	TP-2 3'-7'	2.2	ND	8.4	ND	10.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MP-19	TP-3 0-3'	5.8	ND	95.1	31.4	37.2	ND	ND	2.1	5.9	27	ND	1.4	2.8	8.4	6.3	1.3	ND	ND	6.5	5.9	ND
MP-20	TP-3 3'-7'	9.8	ND	23.2	94.6	20.5	ND	ND	5.4	6.1	12	ND	2.9	6.3	11	16	2.4	1.3	1.1	18	15	3.2
MP-21	TP-3 7'-BTM	5.3	ND	18.4	74.8	15.2	ND	ND	1.7	3.5	6.6	ND	ND	4.5	5.8	5.4	1.0	ND	ND	4.5	6.3	ND
MP-22	B-19-SDWL-3 0-3'	2.6	1.2	58.4	21.5	19.0	ND	ND	ND	3.8	9.2	ND	ND	8.4	6.0	3.2	ND	ND	ND	1.5	3.4	ND
MP-23	B-19-FLR-2	2.6	ND	84.3	21.8	23.9	ND	ND	ND	2.4	5.1	ND	1.1	3.8	3.8	3.4	ND	ND	ND	2.6	3.8	1.2

ND - Not Detected BOLD - Concentration Exceeded Site-Specific Cleanup Criteria

(continued)

(continued)

CONFIRMATIONAL SAMPLING ANALYTICAL SUMMARY (mg/kg)
(SAMPLES COLLECTED INTERIOR TO BASEMENT – AUGUST–SEPTEMBER 1993)
AUTO ION SITE
KALAMAZOO, MICHIGAN

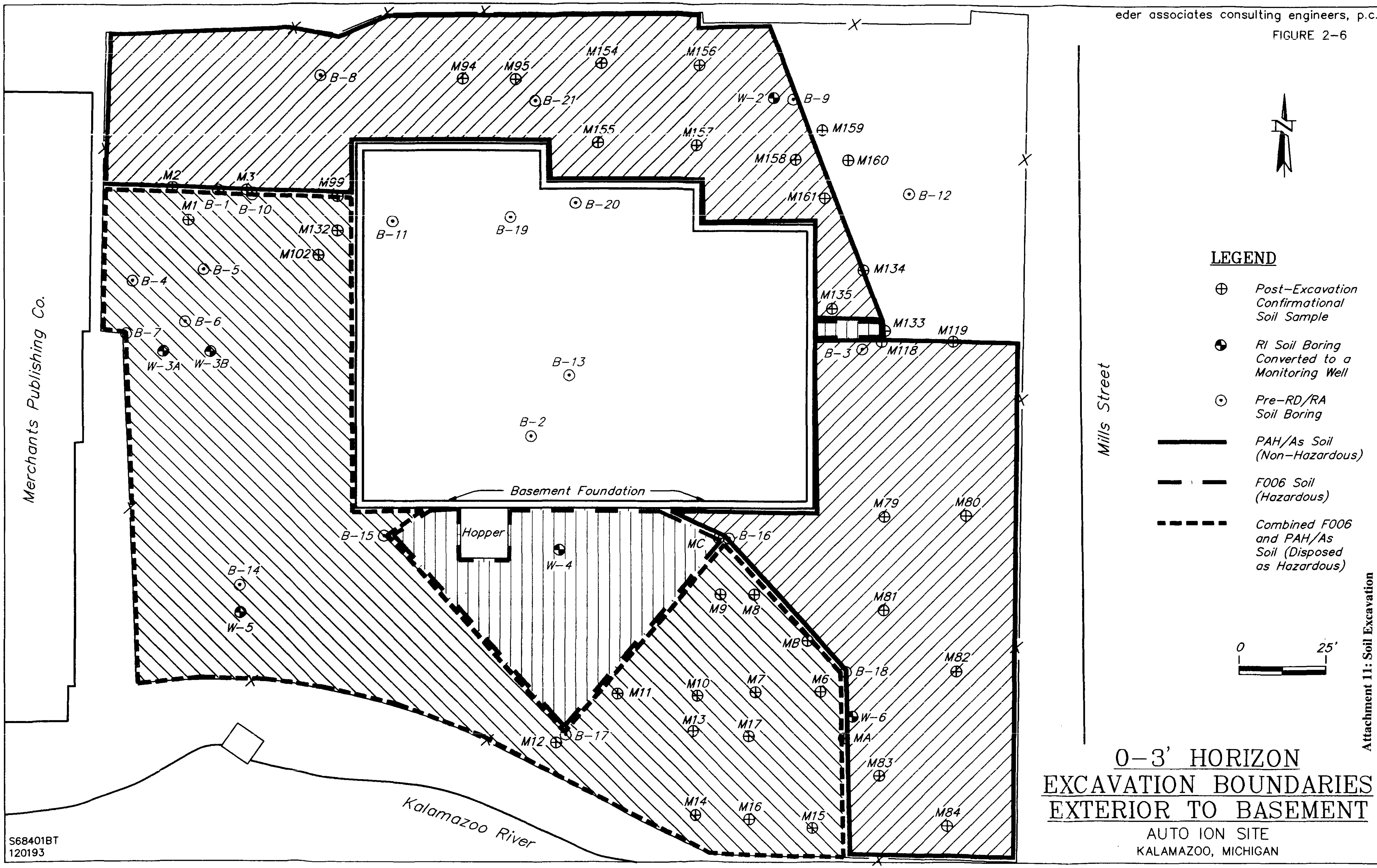
DESIGNATED SAMPLE IDENTIFICATION	EDER SAMPLE IDENTIFICATION	Arsenic	Cadmium	Chromium	Lead	Nickel	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Benzo(a)pyrene	Chrysene	Fluoranthene	Fluorene	Indeno(1,2,3–cd)pyrene	Naphthalene	Phenanthrene	Pyrene	Dibenzo(a,h)anthracene
MP–24	B–19–SDWL–4 0–3'	4.6	ND	6.5	ND	5.7	ND	ND	2.8	5.4	15	ND	5.2	8.0	12	23	1.6	1.9	ND	19	21	5.9
MP–25	B–19–SDWL–4 3'–7'	3.7	ND	10.2	ND	7.9	ND	ND	1.9	2.8	6.2	ND	2.5	3.3	5.4	8.3	1.0	ND	ND	7.7	7.8	2.3
MP–26	B–19–FLR–3	6.3	ND	58.8	59.0	32.9	3.1	1.1	6.9	8.3	18	ND	5.0	10	15	25	3.9	2.2	4.4	28	23	6.4
MP–27	B–19–SDWL–5 0–3'	2.8	ND	12.8	33.8	8.1	1.4	ND	3.5	11	10	11	7.7	12	13	26	1.3	7.8	ND	18	21	2.0
MP–28	B–19–SDWL–6 0–3'	11.8	ND	36.6	36.0	20.6	ND	ND	ND	5.6	ND	ND	ND	ND	5.6	9.8	ND	ND	ND	8.3	7.5	ND
MP–29	B–19–FLR–4	3.7	ND	5.6	ND	4.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.8	ND	ND	ND	1.0	1.4	ND
MP–30	TP–1–SDWL–1 3'–7'	17.2	ND	356	99.4	92.8	ND	ND	14	27	24	24	12	22	32	57	6.0	13	ND	55	43	ND
MP–31	TP–1–SDWL–2 3'–7'	10.5	ND	518	74.1	229	ND	ND	5.4	9.9	7.0	7.2	ND	8.2	10	18	ND	ND	ND	19	14	ND
MP–32	TP–3–SDWL–1 3'–7'	3.4	ND	29.5	29.0	17.9	ND	ND	ND	1.1	ND	ND	ND	ND	ND	1.2	ND	ND	ND	1.3	ND	ND
MP–33	TP–3–SDWL–2 0–3'	6.4	ND	150	63.9	64.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.2	ND	ND	ND	7.1	5.8	ND
MP–34	B–19–SDWL–7 0–3'	5.8	ND	109	35.1	24.8	ND	ND	2.6	7.1	6.7	6.8	4.7	6.8	8.2	17	ND	4.8	ND	12	13	ND
MP–35	B–19–FLR–5	7.4	ND	66.6	30.8	25.8	ND	ND	11	24	24	25	18	24	30	63	5.2	17	ND	51	49	ND
MP–36	TP–1–SDWL–3 3'–7'	8.7	ND	95.9	62.4	42.6	ND	ND	5.5	9.5	8.8	ND	3.8	10	9.5	18	2.9	4.2	ND	18	13	ND
MP–37	B–19–SDWL–8 3'–7'	5.0	ND	81.4	65.6	33.6	ND	ND	1.0	3.3	3.5	3.2	2.7	3.0	3.2	8.0	ND	2.6	ND	4.8	6.7	ND
MP–38	B–19–SDWL–9 3'–7'	1.1	ND	6.5	11.2	5.4	ND	ND	1.1	2.9	3.0	2.7	2.1	2.6	2.9	8.1	ND	2.1	ND	6.2	6.5	ND
MP–39	TP–1–SDWL–4 0–3'	8.5	1.8	75.4	144	40.6	21	ND	67	97	71	58	38	68	85	200	37	44	22	230	160	18
MP–40	TP–1–SDWL–5 3'–7'	7.6	ND	127	43.0	61.1	1.5	ND	4.0	6.8	5.5	4.4	3.1	5.0	6.2	14	2.3	3.4	1.5	15	11	1.1
MP–41	TP–1–SDWL–6 0–3'	12.0	ND	141	67.8	63.5	5.5	ND	16	21	13	13	5.5	13	19	51	8.6	6.7	6.8	56	37	2.5
MP–42	TP–1–SDWL–7 3'–7'	9.7	ND	174	71.4	81.5	1.7	ND	5.3	7.9	4.8	ND	1.9	4.9	7.2	17	2.7	2.3	1.6	18	13	ND

ND – Not Detected BOLD – Concentration Exceeded Site–Specific Cleanup Criteria

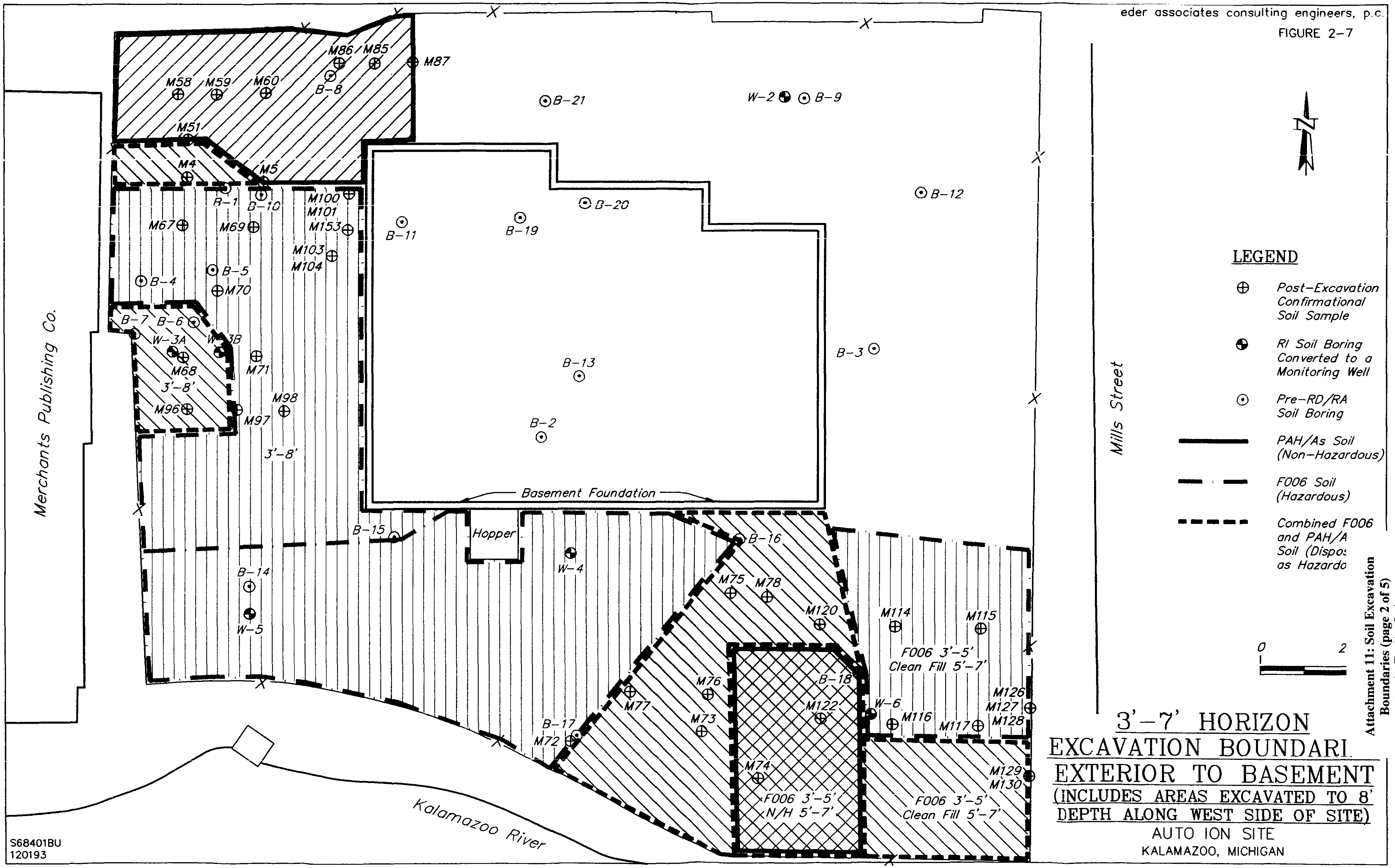
Attachment 10: Confirmational Sample Locations and Results for Soil Excavation (page 10 of 10)

MS68404N
120293

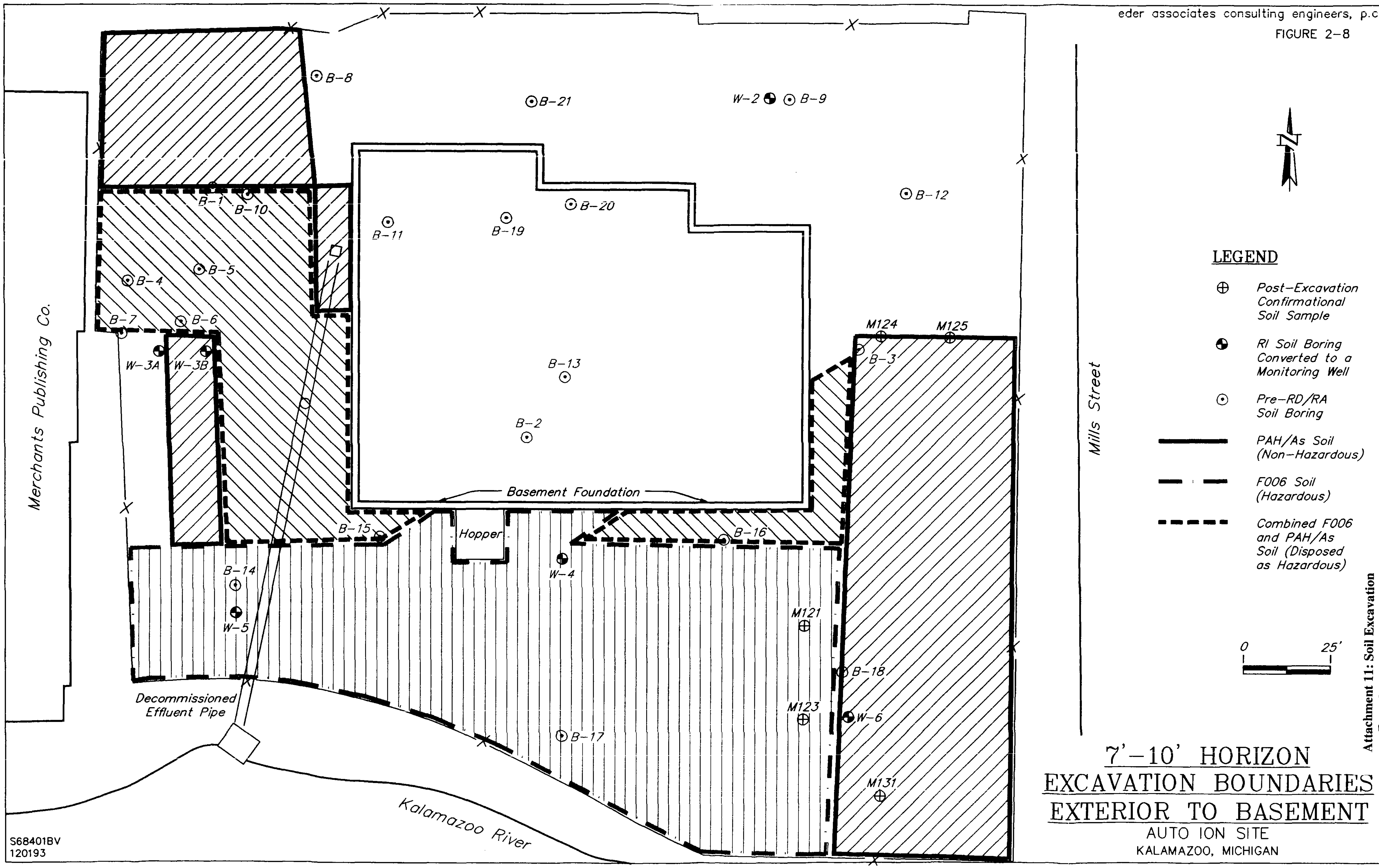
ATTACHMENT 11



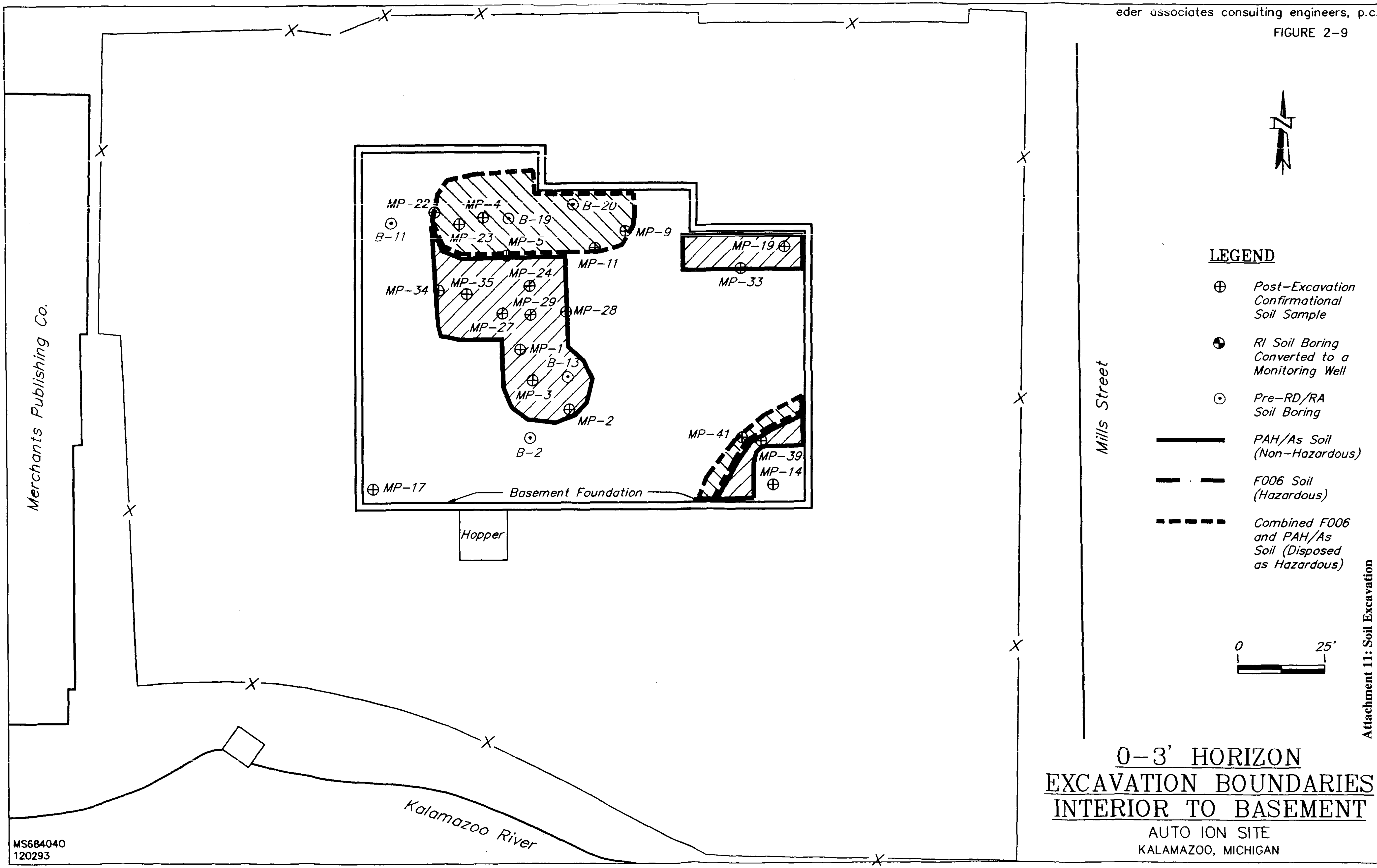
Attachment 11: Soil Excavation Boundaries (page 1 of 5)
Auto Ion Five-Year Review
September 2006



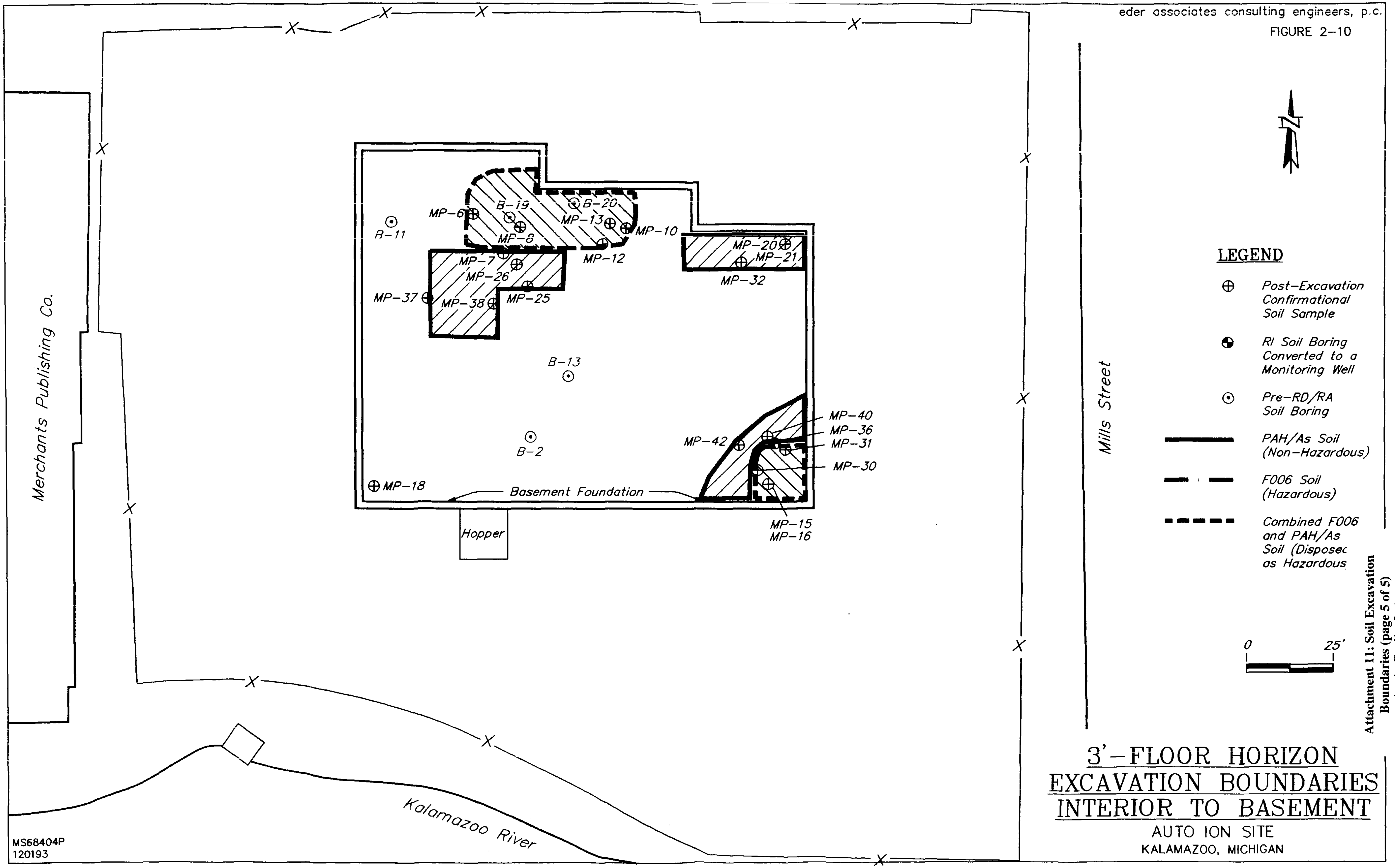
Attachment 11: Soil Excavation Boundaries (page 2 of 5)
Auto Ion Five-Year Review
September 2006



Attachment 11: Soil Excavation Boundaries (page 3 of 5)
Auto Ion Five-Year Review
September 2006



Attachment 11: Soil Excavation Boundaries (page 4 of 5)
Auto Ion Five-Year Review
September 2006



Attachment 11: Soil Excavation Boundaries (page 5 of 5)
Auto Ion Five-Year Review
September 2006

ATTACHMENT 12

MEMORANDUM

TO:	Julian Hayward	REF. NO.:	9182/pw/50
FROM:	Wesley Dyck	DATE:	December 30, 2004

RE: **Final Alternate Concentration Limit (ACL) Values for Groundwater, Revision #2**
Auto Ion Site
Kalamazoo, Michigan

1.0 INTRODUCTION

At a meeting in Plymouth, Michigan, on June 8th, 2004, attended by representatives from Conestoga-Rovers & Associates (CRA), the State of Michigan's Department of Environmental Quality (MDEQ), the United States Environmental Protection Agency (USEPA) and the Auto-Ion Group, a final agreement was reached on the methodology to be employed in developing statistically-based alternate concentration limits (ACLs) for use in evaluating groundwater monitoring data at the Auto Ion site in Kalamazoo, Michigan (Site). In subsequent discussions, a final list of constituents of concern (COCs) for the groundwater monitoring program was also agreed upon. This memorandum presents ACLs calculated using the agreed-upon methodology (see Section 2) for the final list of COCs. (Note that this memorandum is an updated version of CRA's earlier memo dated August 26, 2004).

2.0 ACL METHODOLOGY

The methodology for calculating ACLs was first presented in the Remedial Design Work Plan (CRA, 1998). Subsequent correspondence and discussion between the Agencies and CRA clarified and modified portions of the methodology to arrive at a final ACL calculation protocol. The methodology is as follows.

- A separate ACL is calculated for each COC at each individual monitoring well;
- ACLs are calculated using available data from the baseline period of November 1997 – December 1999 (eight monitoring events);
- As the default, censored (non-detect) results were substituted with one-half their associated detection limits prior to initial data characterization (note that other approaches were later used for (i) target detection limit, (ii) non-parametric and (iii) Aitchison's method ACL data sets);
- Any field duplicate results were averaged prior to data analysis. In cases where field duplicate results included one detected and one non-detect value, the detected value and the full detection limit reported were averaged;
- The detection frequency was calculated for each parameter;
- The data distribution (i.e., normality, log-normality or non-normality) was evaluated using the Shapiro-Wilk W-test, supplemented by probability plotting for selected data sets;
- The presence of statistical outliers was tested using Dixon's test, probability plotting and/or other considerations (e.g., the Agencies considered a "rule of thumb" in cases where a single detected value occurred with seven non-detect results in a baseline set, identifying the single detect as an outlier if the value was more than ten times the detection limits of the seven non-detect samples);

Note that a single-comparison false positive rate (α) of 0.05 was selected, and should not be confused with the site-wide false positive rate (α*).

3.0 RESULTS

The calculated final ACLs are presented in Table 1. Details of the ACL calculations for zinc, are given in Attachment A. Preliminary ACLs, which employed a single-comparison false positive rate (α) of 0.01 instead of 0.05, were previously presented in the Preliminary ACL Establishment Report (CRA, October 2000).

The following noteworthy findings were identified during calculations and in correspondence with the Agencies:

- All but two data sets with 0-50% non-detects were determined to be normally distributed;
- Vinyl chloride at MW4A and zinc at MW4B were determined to be log-normally distributed;
- A total chromium concentration of 1200 μg/L at MW4A was rejected as a statistical outlier by the Agencies;
- A total chromium concentration of 870 μg/L at MW5A was rejected as a statistical outlier by the Agencies;
- A nickel concentration of 630 μg/L at MW5A was rejected as a statistical outlier by Dixon's test;
- A zinc concentration of 630 μg/L was identified by CRA as a suspected outlier (and was removed from the data set) applying the Agencies' "rule of thumb" approach. This was confirmed by the Agencies;
- Two zinc concentrations (360 and ND(190) μg/L) at MW5C were identified by CRA as potential statistical outliers using Dixon's test, but the CARStat statistical program used by the Agencies did not confirm this finding, and the two data points were therefore retained in the data set for ACL calculations; and
- MDEQ has gone on record disagreeing with treating the observations of 59.5 μg/L for lead and 380 μg/L for vinyl chloride at MW4A as valid, but these two values have been retained for the ACL calculations.

It is important to note that there were some modifications to the list of COCs outlined in the RD Work Plan. The following chemicals are no longer COCs: barium, cadmium, chromium VI, copper, lead, silver, bis(2-ethylhexyl)phtalate, and 1,2-dichloroethane. Zinc was added to the list of COCs.

4.0 CONCLUSIONS

The final ACLs presented in Table 1 are the result of significant effort and discussion between the Agencies and CRA, and are believed to provide appropriate, technically-sound screening values against which future data may be evaluated to identify any potential increases in COC concentrations in groundwater underlying the Site. These ACLs have been developed as an important component of an overall evaluation procedure, and are to be interpreted applying a single verification sample model (see Section 3.0) to identify and confirm any ACL exceedances. Any confirmed exceedances will be further evaluated using the specified procedures outlined in the RD Workplan (CRA, 1998).

- The resulting data sets (outliers removed, data distributions and non-detect ratios identified) were used to calculate ACLs using the following specific methods:

Data Distribution	*Percentage of Non-detects* 0-15%	>15-50%	>50-99%	100%
Normal	Parametric	Parametric with Aitchison	Non-Parametric	Target Detection Limit
Lognormal	Parametric-Log	Parametric-log with Aitchison	Non-Parametric	Target Detection Limit
Not normal	Non-parametric	Non-parametric	Non-Parametric	Target Detection Limit

- In cases requiring Aitchison's adjustment (i.e., >15-50% non-detect, parametric data sets, the non-detect–adjusted mean was calculated as (equation (5) of Aitchison, 1955):

$$\bar{x}_{adj} = \left(1 - \frac{d}{n}\right)\bar{x}_{\det}$$

where:
$\bar{x}_{adj}$ = Aitcheson's method adjusted mean;
d = the number of non-detects present in the data set;
n = the total number of samples present in the data set; and
$\bar{x}_{\det}$ = the mean of detected samples in the data set.

The non-detect-adjusted standard deviation was calculated as (equation (10) of Aitchison, 1955):

$$s_{adj} = \sqrt{\left(1 - \frac{d}{n}\right)s_{\det}^2 + \frac{d}{n}\left(1 + \frac{d-1}{n-1}\right)\bar{x}_{\det}^2}$$

where:
s_{adj} = Aitcheson's method adjusted standard deviation;
$d, n, and\ \bar{x}_{\det}$ are as above; and
$s_{\det}^2$ = the variance of detected samples in the data set.

Note that the equation for the standard deviation differs from that given in USEPA (1992), but is consistent with the results generated by the CARstat computer programs used by the Agencies for ACL calculations.

- ACLs are calculated as statistical 95-percent upper prediction limits (UPLs) on the next future sample, considering a single verification resample for calculation of side-wide false positive rates; and
- An ACL exceedance is defined as two consecutive monitoring events where a parameter is detected at an individual well at a concentration above the ACL. If a single concentration above the ACL is found, but the subsequent sample is below the ACL, then no exceedance has occurred.

Note that a single-comparison false positive rate (α) of 0.05 was selected, and should not be confused with the site-wide false positive rate (α*).

3.0 RESULTS

The calculated final ACLs are presented in Table 1. Details of the ACL calculations for zinc, are given in Attachment A. Preliminary ACLs, which employed a single-comparison false positive rate (α) of 0.01 instead of 0.05, were previously presented in the Preliminary ACL Establishment Report (CRA, October 2000).

The following noteworthy findings were identified during calculations and in correspondence with the Agencies:

- All but two data sets with 0-50% non-detects were determined to be normally distributed;
- Vinyl chloride at MW4A and zinc at MW4B were determined to be log-normally distributed;
- A total chromium concentration of 1200 μg/L at MW4A was rejected as a statistical outlier by the Agencies;
- A total chromium concentration of 870 μg/L at MW5A was rejected as a statistical outlier by the Agencies;
- A nickel concentration of 630 μg/L at MW5A was rejected as a statistical outlier by Dixon's test;
- A zinc concentration of 630 μg/L was identified by CRA as a suspected outlier (and was removed from the data set) applying the Agencies' "rule of thumb" approach. This was confirmed by the Agencies;
- Two zinc concentrations (360 and ND(190) μg/L) at MW5C were identified by CRA as potential statistical outliers using Dixon's test, but the CARStat statistical program used by the Agencies did not confirm this finding, and the two data points were therefore retained in the data set for ACL calculations; and
- MDEQ has gone on record disagreeing with treating the observations of 59.5 μg/L for lead and 380 μg/L for vinyl chloride at MW4A as valid, but these two values have been retained for the ACL calculations.

It is important to note that there were some modifications to the list of COCs outlined in the RD Work Plan. The following chemicals are no longer COCs: barium, cadmium, chromium VI, copper, lead, silver, bis(2-ethylhexyl)phtalate, and 1,2-dichloroethane. Zinc was added to the list of COCs.

4.0 CONCLUSIONS

The final ACLs presented in Table 1 are the result of significant effort and discussion between the Agencies and CRA, and are believed to provide appropriate, technically-sound screening values against which future data may be evaluated to identify any potential increases in COC concentrations in groundwater underlying the Site. These ACLs have been developed as an important component of an overall evaluation procedure, and are to be interpreted applying a single verification sample model (see Section 3.0) to identify and confirm any ACL exceedances. Any confirmed exceedances will be further evaluated using the specified procedures outlined in the RD Workplan (CRA, 1998).

5.0 REFERENCES

Aitchison, J., 1955. On the Distribution of a Positive Random Variable Having a Discrete Probability Mass at the Origin. Journal of the American Statistical Association 50(271): 901-908.

CRA, 1998. Remedial Design Work Plan for Operable Unit 2, Auto Ion Site, Kalamazoo, Michigan.

CRA 2000. Preliminary Alternate Concentration Limit Establishment Report, Auto Ion Site, Kalamazoo, Michigan.

CRA, October 2000. Responses to Issues Raised by MDEQ Regarding Preliminary Alternate Concentration Limit Calculations, Auto Ion Site, Kalamazoo, Michigan. Letter from Ed McBean/Wesley Dyck (CRA) to Sirtaj Ahmed & Mary Schafer, October 5th, 2000.

USEPA, July 1992. Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Draft Addendum to Interim Final Guidance. Office of Solid Waste, United States Environmental Protection Agency, Washington D.C.

ATTACHMENT A

MEMORANDUM

TO:	Julian Hayward	REF. NO.:	9182
FROM:	Wesley Dyck; Daniela Araujo	DATE:	December 30, 2004 (Memo-50 Attach.)
RE:	**Alternate Concentration Limits for Zinc, Revision #2 Auto Ion Site Kalamazoo, Michigan**		

1.0 INTRODUCTION

This memorandum presents the calculations of the Alternate Concentration Limits (ACLs) for zinc in Point of Compliance (POC) groundwater monitoring wells at the Auto Ion Site (Site) in Kalamazoo, Michigan. Zinc has been identified as a chemical of concern and added to the parameter list for statistical evaluation in subsequent monitoring events (Rounds). (Note that this memorandum is an updated version of CRA's earlier memo dated August 9, 2004.)

2.0 STATISTICAL METHODS

Methodologies for the calculation of ACLs are presented within the Remedial Design Work Plan (CRA, 1998), modified by subsequent discussions with the Agencies (USEPA, 2003, 2004; Stakeholders, 2004). The calculation of ACLs for zinc at POC monitoring wells follows the final agreed-upon methodologies.

The first 8 data points (data from Rounds 1 to 8) were used to calculate parametric or non-parametric 95 percent (i. e., α=0.05) upper prediction limits (UPLs) on a per-well basis. These calculated UPL values are used as ACLs for future comparisons of individual monitoring results at the well.

The proportion of non-detects, data distribution, and presence of statistical outliers were assessed for each zinc data set (one per POC well). Normality was assessed using the Shapiro-Wilk W-Test and probability plotting. Outliers were tested for using Dixon's test and informal "rule-of-thumb" approach applied by the Agencies. Any others identified were excluded from ACL calculations. In calculations, any non-detects were substituted by one-half their detection limit. If the data set consisted of fewer than 50 percent non-detect results and the data were normally or lognormally distributed, then parametric procedures were used. Otherwise, nonparametric procedures were applied, since these methods make no distributional assumptions.

3.0 CALCULATION DETAILS AND RESULTS

Table 1 shows the raw data from Rounds 1 to 8 for zinc at each POC well. Additional data from subsequent monitoring events (Rounds 9-22) were used for further confirmation of outliers and/or data distribution in POC monitoring wells MW-5A and MW-5C.

Table 2 summarizes the ACL calculations for zinc at each POC monitoring well. In two cases (MW-3A and

MW-4A) with 100-percent non-detect results during the baseline period, the method 200.7 and 6010B Target Analyte Reporting Limit in Water (20 ug/L) reported in the Remedial Design Work Plan was used for the ACL.

In MW-5A, one outlier was identified (630 ug/L) applying the Agencies "rule of thumb" (greater than ten times the next highest value or detection limit in a mainly non-detect data set). Further consideration of all monitoring events to date through (Round 22) suggested that this value was, in fact, an outlier. This outlier was subsequently confirmed by the Agencies. At MW-5C, two outliers (360 and ND (190) ug/L) were identified using Dixon's test. However, the statistical program used by the Agencies, CARstat, did not identify these points as outliers and they were therefore retained in the data set for ACL calculations.

The calculated ACLs for zinc in POC wells at the site, as presented in Table 2, should be used to evaluate subsequent monitoring data (i.e., post-baseline). Consistent with the other monitoring parameters, a verification resample is required to confirm any apparent exceedance.

4.0 REFERENCES

Conestoga-Rovers & Associates, July 1998. "Remedial Design (RD) Work Plan for Operable Unit 2", Auto Ion Site, Kalamazoo, Michigan.

Stakeholders, 2004. Joint Meeting of Agencies, CRA, and PRP group representatives. Plymouth, Michigan, June 8th, 2004.

USEPA, 2003. Agency Comments on Proposed ACLs, Auto Ion Site, Kalamazoo, Michigan. Letter from Mary Tierney to Julian Hayward and John Buyers, July 11th, 2003.

USEPA, 2004. Final Values for Alternate Concentration Limits (ACLs), Auto Ion Site, Kalamazoo, Michigan. Letter from Mary Tierney to Julian Hayward, April 7th, 2004.

TABLE 1

SAMPLE DATA FOR ZINC IN POINT OF COMPLIANCE (POC) GROUNDWATER MONITORING WELLS
AUTO ION SITE
KALAMAZOO, MICHIGAN

Monitoring Round	*Date*	*Group*	*POC Monitoring Wells*							
			MW-3A ug/L	*MW-3B ug/L*	*MW-4A ug/L*	*MW-4B ug/L*	*MW-5A ug/L*	*MW-5B ug/L*	*MW-5C ug/L*	*MW-5D ug/L*
1	November-97	*Baseline*	ND (20)	ND (20) U	ND (20)	22	ND (20) U	ND (20)	**ND (190) U**	1100/1000
2	April-98	*Baseline*	ND (51) U	ND (20)	ND (130) U/ND (130) U	200	**630**	ND (63) U	**360**	900
3	July-98	*Baseline*	ND (20)	ND (20)	ND (20)	ND (73) U	ND (20)/ND (20)	ND (25) U	220	910
4	September-98	*Baseline*	ND (20)	ND (20)	ND (20)	48	ND (20)	ND (20)	190	900
5	January-99	*Baseline*	ND (20)	25	ND (20)	330	25	ND (20)	190/190	770
6	May-99	*Baseline*	ND (20)	ND (20)	ND (20)	67	23	61	180/190	950
7	September-99	*Baseline*	ND (20.0)	22.6	ND (20.0)	71.0	ND (20.0)/ND (20.0)	34.4 J	205	1190
8	December-99	*Baseline*	ND (20.0)	30.8	ND (20.0)	34.7	ND (20.0)	35.9/23.7	173	1200
9	February-00	*Monitoring*					38.0/ND (20.0)		204	
10	June-00	*Monitoring*					ND (20.0)/ND (20.0)		171	
11	November-00	*Monitoring*					ND (20.0)		173/157	
12	April-01	*Monitoring*					37.9		168	
13	June-01	*Monitoring*					ND (20.0)		116	
14	August-01	*Monitoring*					ND (20.0)		158/156	
15	November-01	*Monitoring*					ND (20.0)		130/129	
16	April-02	*Monitoring*					ND (20.0)/ND (20.0)		129	
17	June-02	*Monitoring*					ND (20.0)		143	
18	August-02	*Monitoring*					ND (20.0)/ND (20.0)		148	
19	October-02	*Monitoring*					ND (20.0)		140	
20	December-02	*Monitoring*					ND (20.0)		139	
21	April-03	*Monitoring*					ND (20.0)		ND (20.0)	
22	January-04	*Monitoring*					ND (20.0)		102	

Attachment 12: Statistical Methods for Calculating ACLs (page 8 of 9)
Auto Ion Five-Year Review
September 2006

Note:
Results in **Bold** indicate outliers according to Dixon's test and/or other analysis.

TABLE 2

SUMMARY OF STATISTICAL ANALYSIS AND ALTERNATE CONCENTRATION LIMIT (ACL) CALCULATION FOR ZINC
AUTO ION SITE
KALAMAZOO, MICHIGAN

Monitoring Well	*Statistical Outliers*	*Detection Frequency*	*%ND*	*Distribution*	*ACL Method*	*Minimum*	*Maximum*	*Mean (ug/L)*	*S.D. (ug/L)*	*Raw ACL (ug/L)*	*Final ACL (ug/L)*
MW-3A	n/a	0/8	100%	Non-Detect	target detection limit	ND (20)	ND (51) U	11.94	5.48	ND (20) [1]	20
MW-3B	none	3/8	63%	>50% Non-Detect	non-parametric	ND (20) U	30.8	16.05	8.65	30.8	30.8
MW-4A	n/a	0/8	100%	Non-Detect	target detection limit	ND (20)	ND(130)	16.88	19.45	ND (20) [1]	20
MW-4B	none	7/8	13%	Lognormal	parametric-log	22	330	4.21	0.918	425.3	425
MW-5A	630 ug/L [2]	2/7	71%	>50% Non-Detect	non-parametric	ND (20) U	25	41.36	131.68	25	25
MW-5B	none	3/8	63%	>50% Non-Detect	non-parametric	ND (20)	61	24.90	18.05	61	61
MW-5C	none	7/8	13%	Normal	parametric	173	360	202.25	73.84	350.6	351
MW-5D	none	8/8	0%	Normal	parametric	770	1200	983.75	151.18	1287.5	1288

Note:

[1] Method 200.7 and 6010B Target Analyte Reporting Limit in Water (ug/L) of Remedial Design Work Plan.

[2] Outlier confirmed in consideration of Rounds 9-22 data in consultation with Agencies using Rule of Thumb (10x next highest value in mainly non-detect data set) approach.

Parametric -- ACL calculated as a statistical upper prediction limit on the next future sample (individual comparison a = 0.05).

Non-parametric -- ACL established using the highest value of the baseline period as a non-parametric statistical upper prediction limit on the next future sample (for 8 baseline samples, the non-parametric individual comparison a = 0.11).

Target Detection Limit -- ACL taken from the target detection limit for parameters with no detections at a given well during the baseline period.

182)

ATTACHMENT 13

TABLE 1

FINAL ACL VALUES (ALPHA=0.05)
AUTO ION SITE
KALAMAZOO, MICHIGAN
REVISED: 1/19/05

Chemical	*Monitoring Well*	*Final ACL $\alpha = 0.05$*
Arsenic	MW3A	44.9
Arsenic	MW3B	123
Arsenic	MW4A	47.9
Arsenic	MW4B	129
Arsenic	MW5A	63
Arsenic	MW5B	11
Arsenic	MW5C	67.0
Arsenic	MW5D	124
Chromium	MW3A	12
Chromium	MW3B	11
Chromium	MW4A	10
Chromium	MW4B	19.7
Chromium	MW5A	23
Chromium	MW5B	30.1
Chromium	MW5C	17
Chromium	MW5D	42.6
Cyanide	MW3A	10
Cyanide	MW3B	10
Cyanide	MW4A	11
Cyanide	MW4B	10
Cyanide	MW5A	70
Cyanide	MW5B	10
Cyanide	MW5C	10
Cyanide	MW5D	10
Mercury	MW3A	0.21
Mercury	MW3B	0.24
Mercury	MW4A	0.20
Mercury	MW4B	0.20
Mercury	MW5A	0.20
Mercury	MW5B	0.20
Mercury	MW5C	0.20
Mercury	MW5D	0.20
Nickel	MW3A	64
Nickel	MW3B	3298
Nickel	MW4A	749
Nickel	MW4B	851
Nickel	MW5A	98
Nickel	MW5B	389
Nickel	MW5C	810
Nickel	MW5D	9003

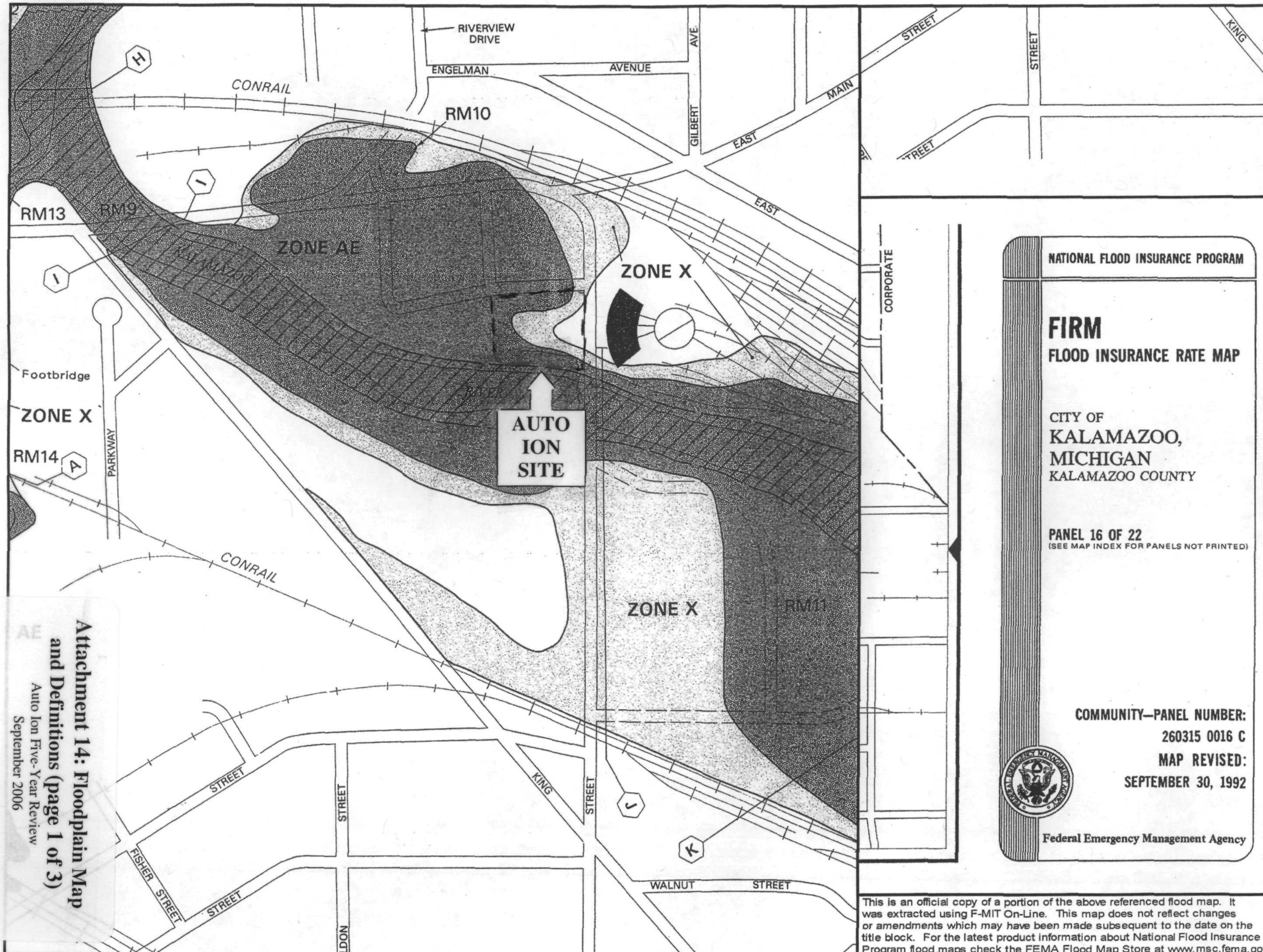
Attachment 13: Final ACL Values
(page 1 of 2)

TABLE 1

FINAL ACL VALUES (ALPHA=0.05)
AUTO ION SITE
KALAMAZOO, MICHIGAN
REVISED: 1/19/05

Chemical	*Monitoring Well*	*Final ACL* $\alpha = 0.05$
Trichloethylene	MW3A	1.0
Trichloethylene	MW3B	1.0
Trichloethylene	MW4A	1.0
Trichloethylene	MW4B	1.0
Trichloethylene	MW5A	1.0
Trichloethylene	MW5B	1.0
Trichloethylene	MW5C	21.5
Trichloethylene	MW5D	86.7
Vinyl Chloride	MW3A	1.4
Vinyl Chloride	MW3B	1.0
Vinyl Chloride	MW4A	438
Vinyl Chloride	MW4B	1.0
Vinyl Chloride	MW5A	7.1
Vinyl Chloride	MW5B	11.0
Vinyl Chloride	MW5C	7.3
Vinyl Chloride	MW5D	1.0
Zinc	MW3A	20
Zinc	MW3B	30.8
Zinc	MW4A	20
Zinc	MW4B	425
Zinc	MW5A	25
Zinc	MW5B	61
Zinc	MW5C	351
Zinc	MW5D	1288

ATTACHMENT 14



Attachment 14: Floodplain Map and Definitions (page 1 of 3)
Auto Ion Five-Year Review
September 2006

TABLE 4: SFHA ZONE DEFINITION				
Zone Name	**ZONE**	**SFHA**	**SYMBOL**	**Description**
				underway.
Zone X (500-year)	X500	Out	11	An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 100-year flooding.
Zone X	X	Out	12	An area that is determined to be outside the 100- and 500-year floodplains.
100-year Flood Discharge Contained in Channel	100IC	In	13	An area where the 100-year flooding is contained within the channel banks and the channel is too narrow to show to scale. An arbitrary channel width of 3 meters is shown. BFEs are not shown in this area, although they may be reflected on the corresponding profile.
500-year Flood Discharge Contained in Channel	500IC	Out	14	An area where the 500-year flooding is contained within the channel banks and the channel is too narrow to show to scale. An arbitrary channel width of 3 meters is shown.
Floodway Contained in Channel	FWIC	In	15	An area where the floodway is contained within the channel banks and the channel is too narrow to show to scale. An arbitrary channel width of 3 meters is shown. BFEs are not shown in this area, although they may be reflected on the corresponding profile.
Flood Prone Area	FPQ	In	16	An area designated as a "Flood Prone Area" on a map prepared by USGS and the Federal Insurance Administration. This area has been delineated based on available information on past floods. This is an area inundated by 100-year flooding for which no BFEs have been determined.
Area in SFHA	IN	In	17	An area designated as within a "Special Flood Hazard Area" (or SFHA) on a FIRM. This is an area inundated by 100-year flooding for which BFEs or velocity may

TABLE 4: SFHA ZONE DEFINITION				
Zone Name	**ZONE**	**SFHA**	**SYMBOL**	**Description**
Zone V	V	In	1	An area inundated by 100-year flooding with velocity hazard (wave action); no BFEs have been determined.
Zone VE	VE	In	2	An area inundated by 100-year flooding with velocity hazard (wave action); BFEs have been determined.
Zone A	A	In	3	An area inundated by 100-year flooding, for which no BFEs have been determined.
Zone AE	AE	In	4	An area inundated by 100-year flooding, for which BFEs have been determined.
Zone AO	AO	In	5	An area inundated by 100-year flooding (usually sheet flow on sloping terrain), for which average depths have been determined; flood depths range from 1 to 3 feet.
Zone AO (Alluvial Fan)	AOVEL	In	6	An alluvial fan inundated by 100-year flooding (usually sheet flow on sloping terrain), for which average flood depths <u>and</u> velocities have been determined; flood depths range from 1 to 3 feet.
Zone AH	AH	In	7	An area inundated by 100-year flooding (usually an area of ponding), for which BFEs have been determined; flood depths range from 1 to 3 feet.
Zone A99	A99	In	8	An area inundated by 100-year flooding, for which no BFEs have been determined. This is an area to be protected from the 100-year flood by a Federal flood protection system under construction.
Zone D	D	Out	9	An area of undetermined but possible flood hazards.
Zone AR	AR	In	10	An area inundated by flooding, for which BFEs or average depths have been determined. This is an area that was previously, and will again, be protected from the 100-year flood by a Federal flood protection system whose restoration is Federally funded and

ATTACHMENT 15

Kalamazoo Gazette, THURS, APRIL 13, 2006

EPA Will Start a Five-Year Review of the

Auto Ion Chemicals Inc. Superfund Site

Kalamazoo, Michigan

U.S. Environmental Protection Agency is conducting a five-year review of the cleanup at the Auto Ion Chemicals Inc. Superfund site. The Auto Ion Chemical site is located on the north side of the Kalamazoo River near Mills Street. The review is required to ensure the selected plan continues to protect human health and the environment. This review is scheduled to be completed by October 2006. The next five-year review will be in 2011.

The review will check the site operations and maintenance plan for testing ground-water quality and overall effectiveness of the cleanup that was completed in 1994. Among other items, ground-water monitoring well results and site security will be revisited during this review.

Site information can be found at: Kalamazoo Public Library
315 S. Rose St.

Public comment is highly encouraged. Written comments should be postmarked no later than May 19, 2006. Written or oral comments should be addressed to Robert Paulson. Additional site information can be requested from the team members listed below.

Mary Tierney
Remedial Project Manager
EPA Region 5 (SR-6J)
77 W. Jackson Blvd.
Chicago, IL 60604
(312) 886-4785
tierney.mary@epa.gov

Robert Paulson
Community Involvement Coordinator
EPA Region 5 (P-19J)
77 W. Jackson Blvd.
Chicago, IL 60604
(312) 886-0272
paulson.robert@epa.gov

Toll free (800) 621-8431, 10 a.m. to 5:30 p.m. weekdays

4/13/06

Attachment 15: Public Notice about Five-Year Review

ATTACHMENT 16

DOCUMENTS REVIEWED

Report and Recommendation: Finding of Fact, in the Matter of Auto Ion Chemicals Company, Inc., Michigan Department of Natural Resources, November 23, 1973

Final Remedial Action Master Plan, Auto Ion Waste Treatment Facility, 01-5VC4.0, July 30, 1984

Proposed Work Plan for Waste Removal, Auto Ion Site, Auto Ion Technical Steering Committee, August 23, 1984

Memorandum from Stephen Bouchard, U.S. EPA, Region 5, Office of Groundwater, "Review of the Auto Ion Superfund Site Draft Remedial Investigation (RI) Report," October, 12, 1988

Remedial Investigation Report, Auto Ion Incorporated, Fred C. Hart Associates, December 1988

Endangerment Assessment, Auto Ion Incorporated, Fred C. Hart Associates, April 14, 1989

Feasibility Study Report, Operable Unit One, Auto Ion Site, Fred C. Hart Associates, June 1989

Record of Decision for Operable Unit 1, Auto Ion Site, USEPA, September 27, 1989

Consent Decree, Remedial Design/Remedial Action, 1990

Consent Decree, Remedial Design/Remedial Action, 1991

Remedial Design/Remedial Action Work Plan, Auto Ion Site, Eder Associates, October 1991

Interim Health Assessment, Auto Ion Chemicals, Inc., U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR), March 1992

Letter from David Nunn, Eastman & Smith, Auto Ion Steering Committee, to Michael McAteer and Nancy-Ellen Zusman, USEPA, October 6, 1992

Operable Unit 1 Design Report, Auto Ion Site, Eder Associates, February 1993

Explanation of Significant Difference, Auto Ion Site, USEPA, April 23, 1993

USEPA Site Update, Mike McAteer and Lawrence Leveque, USEPA, October 18, 1993

Operable Unit 1 Remedial Action Report, Auto Ion Site, Eder Associates, March 1994

Site Review and Update, Auto Ion Chemicals, Inc., U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR), August 29, 1994

Record of Decision for Operable Unit 2, Auto Ion Site, USEPA, September 23, 1994

DOCUMENTS REVIEWED (continued)

Letter to Mike McAteer, USEPA, from Conestoga Rovers & Associates, December 13, 1995

Contingency Plan/Remedial Action Plan – Part C, RD Work Plan for Operable Unit 2, Auto Ion Site, Conestoga Rovers & Associates, July 1998

Preliminary Alternate Concentration Limit Establishment Report, Auto Ion Site, Conestoga Rovers & Associates, June 2000

Stage I Assessment Report, Volume I – Injury Assessment: Kalamazoo River Environment, and Volume 2 – Economic Assessment: Kalamazoo River Environment, Stratus Consulting, Inc., March 15, 2005

Amended and Restated Brownfield Plan: Tenth Amendment, City of Kalamazoo, May 2005 http://www.kalamazoocity.org/docs/Brownfield%20Plan%2010.pdf

Groundwater Sampling Reports and Confirmational Sampling Reports, Rounds 1 through 26, Conestoga Rovers & Associates (September 1997 to April 2006)

ATTACHMENT 17

Quick Reference Guide
for Charts and Graphs

This document was created as a quick reference guide to reading the charts and graphs included with statistical analysis report. This information has been provided so you may better understand the charts and graphs presented within the reports requested.

GEOS
Groundwater Evaluation and Optimization System

Interpreting the PAM Output Charts

The charts produced by PAM contain a great deal of information, despite their "clean" look. While reading, refer to the figures provided. Each figure reflects one annotated PAM output chart which uniquely highlights the statistical tests conducted for analysis reports.

Each PAM output chart itself shows the results for a single monitoring well location and a single analyte at a particular site. The top center portion of the chart contains these pieces of information.

The top right corner of the chart contains three glyphs (pictographs) representing the results of each of three statistical tests. An upward-pointing red triangle indicates a violation or exceedance of a criterion, a downward-pointing green triangle indicates a compliance to a criterion, an empty orange circle indicates neither exceedance nor compliance, and a filled orange circle indicates that some feature of the dataset warrants attention (e.g., all data are nondetects, but the median reporting detection limit exceeds the standard for comparison). The meaning of each glyph depends on the statistical test, as described in Table 1 below. This table will help you undersatnd

Table 1. Understanding Glyphs

Glyph	Trend Test	Comparison to Standard Test	Comparison to Baseline Test
▲	Increasing trend	UCL exceeds pertinent standard	Latest datum exceeds UPL of baseline period
▼	Decreasing trend	UCL is less than pertinent standard	Latest datum less than LPL of baseline period
●	Not used	All included data were nondetects and reporting detection limit exceeds pertinent standard	Latest datum is nondetect.
○	No trend OR no report (e.g., insufficient data)	No exceedance or compliance OR no report	No change OR no report

Acronyms: UCL = Upper Confidence Limit
UPL = Upper Prediction Limit
LPL = Lower Prediction Limit

not only the charts that each statistical test produces, but also the Summary Chart which displays the test results within one simple table. The bottom right corner of every PAM chart includes a date on which the dataset was analyzed and the name of the organization or entity that prepared the analysis.

The bottom left corner of the PAM chart includes three lines of text, one for each statistical test. These lines give the confidence levels used for each test, as well as the pertinent statistic calculated from the data. (Note that the trend test confidence level is for a two-sided test, unlike some other tools.)

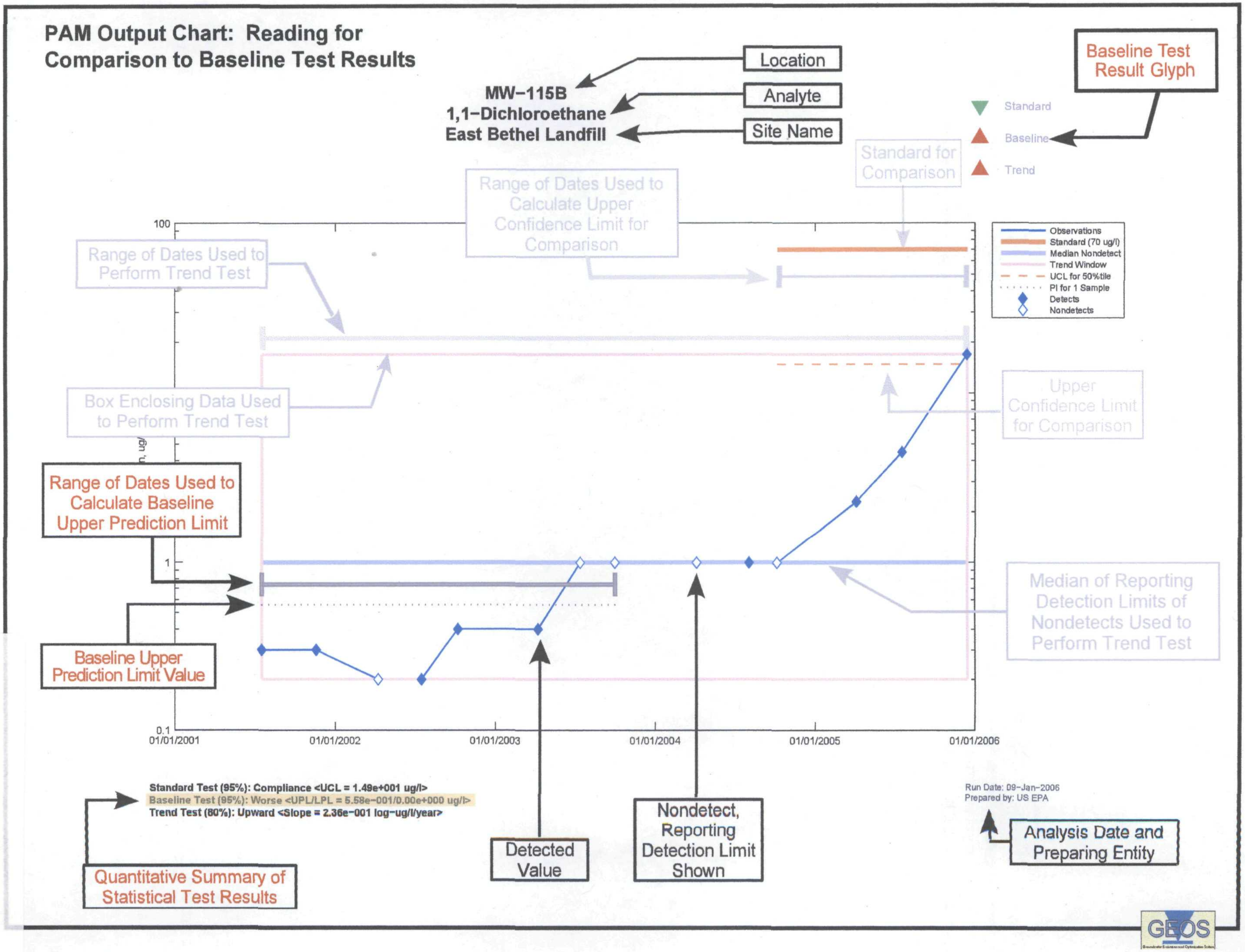
The central portion of the PAM chart is the graph itself. On the right side of the graph is a legend of chart symbols. Analytical data are plotted with blue diamond-shaped markers that are filled if the analyte is detected and open if not detected. In the latter case, the marker is plotted at the reporting detection limit for the sample. A solid blue line connects data.

The comparison to standard test computes an upper confidence limit (shown with a dashed orange line) based on the data for a range of dates (a gray H-beam indicates the range of dates used in the comparison to standard test) and compares the upper confidence limit to a specified criterion or standard (shown with a solid orange line).

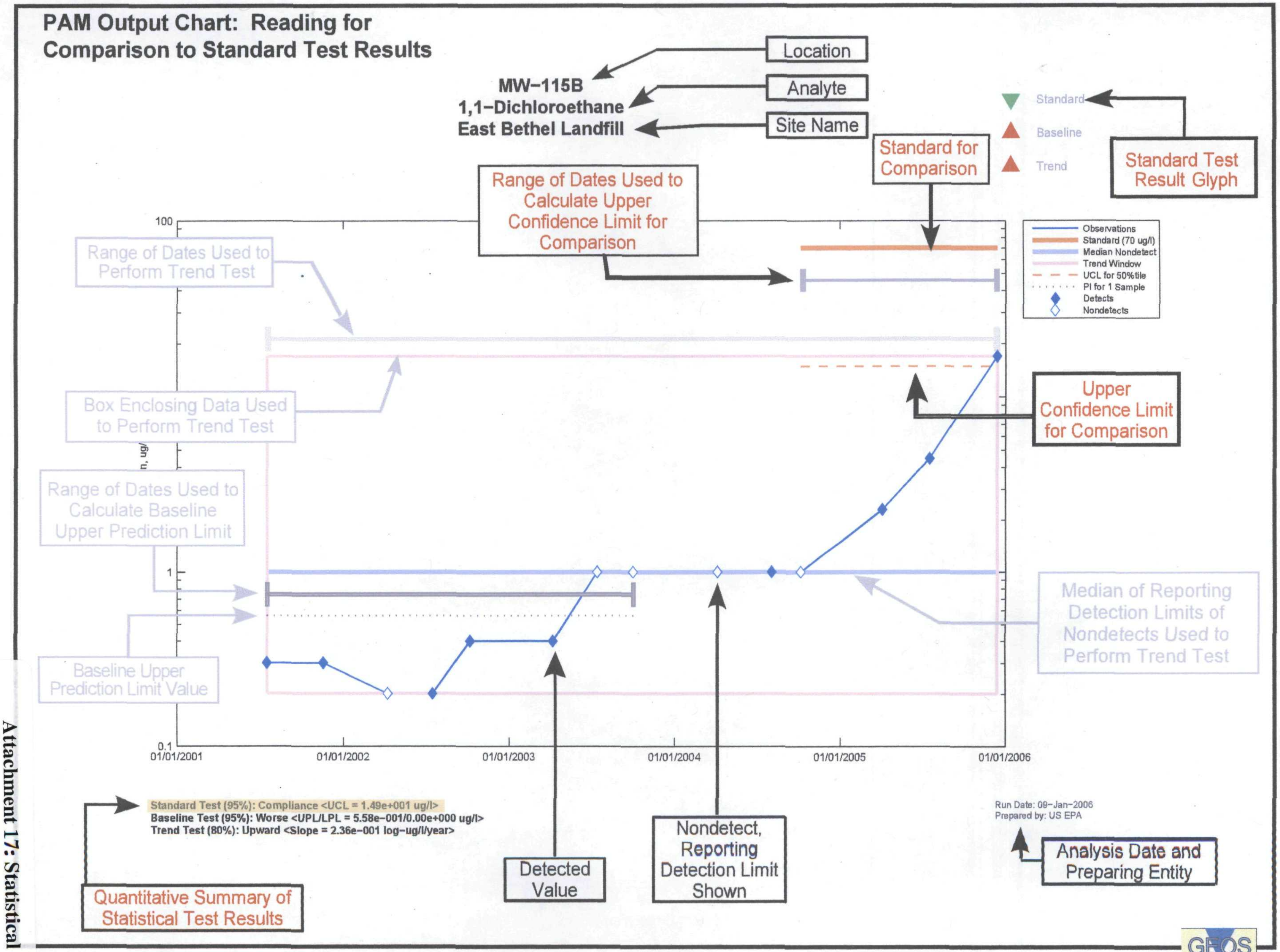
The comparison to baseline test computes a prediction interval (shown with a thick dotted dark magenta box) based on the data for a range of dates (a gray H-beam indicates the range of dates used in the comparison to baseline test) and compares it to the latest available datum in the dataset. A dotted line (rather than a box) means that the upper and lower prediction limits are equal.

The trend test computes the Sen-Mann-Kendall slopes for data within a range of dates (a gray H-beam indicates the date range). Before performing the calculations, nondetects are replaced by a fraction (often ½) of the median reporting detection of all nondetects within the trend test date range (solid pale blue line). The slopes are then analyzed statistically to determine whether there is a trend in the data. The rose-colored box on the PAM output chart indicates the range of dates and concentrations actually used in the trend test.

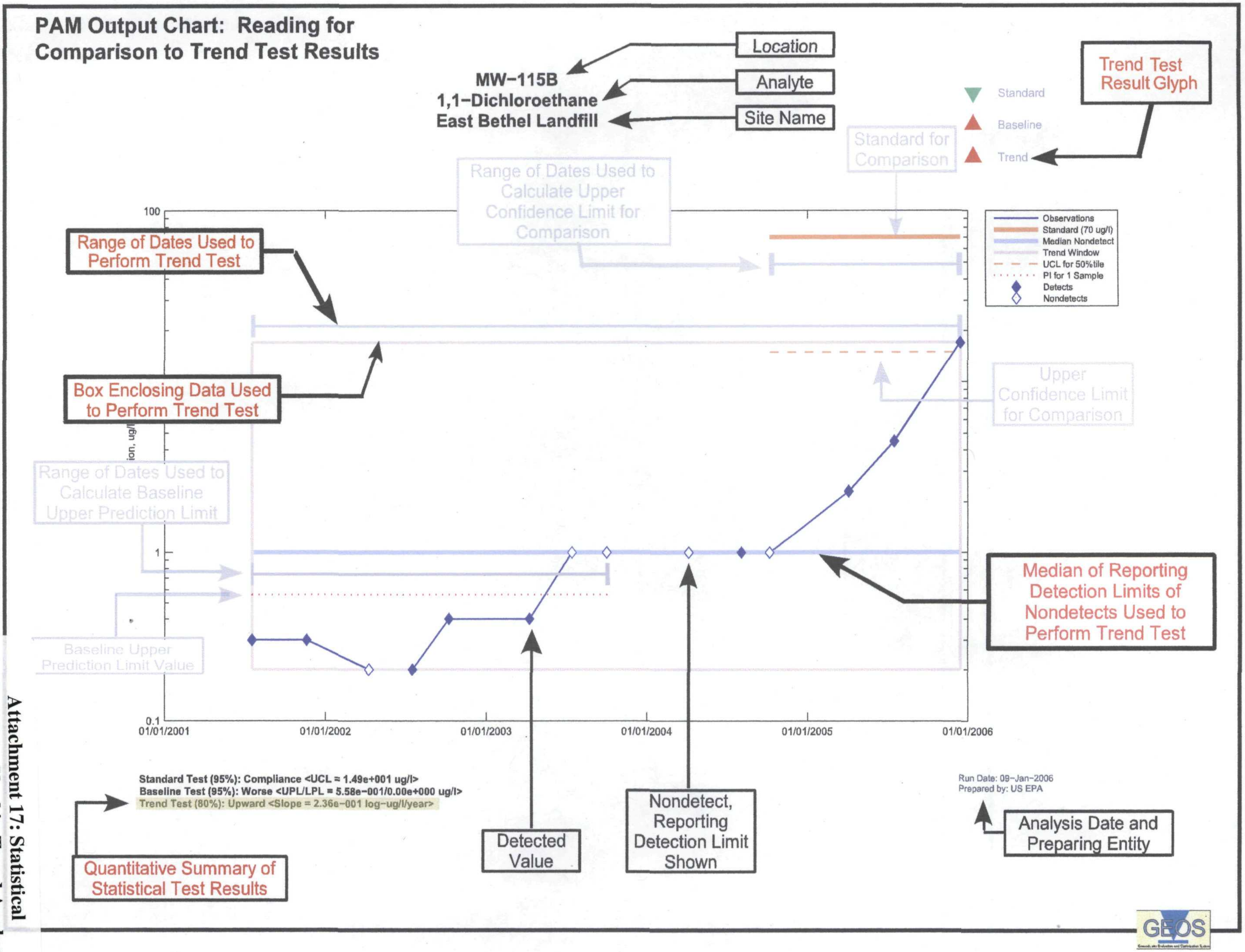
The following charts are included to help you read the results of the statistical tests. All three tests are typically merged into one chart, creating a condensed, streamlined look. Following the PAM Output Charts is a Smaply Summary Output chart, which is typically included within the reports. This chart exhibits a cross-tabular summary of each statistical result for each site well tested.



Attachment 17: Statistical Methodology Used in Trend Analyses (page 3 of 6)
Auto Ion Five-Year Review
September 2006



PAM Output Chart: Reading for Comparison to Standard Test Results
Location
Analyte
Site Name
MW−115B
1,1−Dichloroethane
East Bethel Landfill
Standard for Comparison
Standard
Baseline
Trend
Standard Test Result Glyph
Range of Dates Used to Calculate Upper Confidence Limit for Comparison
Range of Dates Used to Perform Trend Test
Box Enclosing Data Used to Perform Trend Test
Range of Dates Used to Calculate Baseline Upper Prediction Limit
Baseline Upper Prediction Limit Value
Upper Confidence Limit for Comparison
Median of Reporting Detection Limits of Nondetects Used to Perform Trend Test
Observations
Standard (70 ug/l)
Median Nondetect
Trend Window
UCL for 50%tile
PI for 1 Sample
Detects
Nondetects
100
1
0.1
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006
Standard Test (95%): Compliance <UCL = 1.49e+001 ug/l>
Baseline Test (95%): Worse <UPL/LPL = 5.58e−001/0.00e+000 ug/l>
Trend Test (80%): Upward <Slope = 2.36e−001 log−ug/l/year>
Quantitative Summary of Statistical Test Results
Detected Value
Nondetect, Reporting Detection Limit Shown
Run Date: 09−Jan−2006
Prepared by: US EPA
Analysis Date and Preparing Entity
GEOS



Attachment 17: Statistical Methodology Used in Trend Analyses
(page 5 of 6)

Sample Summary Output Chart

Well ID	Benzene		
	T	S	B
MW-104A	▼	▲	○
MW-105B	▼	▼	○
MW-105C			
MW-109A	○	▲	○
MW-110B	○	▲	○
MW-111A			
MW-111C	○	▼	▲
MW-112A	○	▲	●
MW-113A	○	▲	○
MW-115B			
MW-120B	○	▼	▲

T - Trend Test Result
S - Comparison to Standard Test Result
B - Comparison to Baseline Test Result

Glyph	*Trend Test*
▲	Increasing trend
▼	Decreasing trend
●	Not used
○	No trend OR no report (e.g., insufficient data)

Glyph	*Comparison to Standard Test*
▲	UCL exceeds pertinent standard
▼	UCL is less than pertinent standard
●	All included data were nondetects and reporting detection limit exceeds pertinent standard
○	No exceedance or compliance OR no report

Glyph	*Comparison to Baseline Test*
▲	Latest datum exceeds UPL of baseline period
▼	Latest datum less than LPL of baseline period
●	Latest datum is nondetect.
○	No change OR no report

ATTACHMENT 18

Auto Ion				
Analyte Name	Well ID	Units∗	Trend Test (90.0% Confidence)	
			Result	Slope Estimate (Units∗/Yr)
ARSENIC	MW-1A	ug/l	No Trend	0#
ARSENIC	MW-1B	ug/l	No Trend	0#
ARSENIC	MW-3A	ug/l	Downward	-0.1162#
ARSENIC	MW-3B	ug/l	No Trend	-0.004104#
ARSENIC	MW-4A	ug/l	Downward	-0.05846#
ARSENIC	MW-4B	ug/l	Upward	0.05277#
ARSENIC	MW-5A	ug/l	No Trend	0#
ARSENIC	MW-5B	ug/l	No Trend	0#
ARSENIC	MW-5C	ug/l	No Trend	0.001769#
ARSENIC	MW-5D	ug/l	No Trend	0.01063#
CHROMIUM, TOTAL	MW-1A	ug/l	No Trend	0#
CHROMIUM, TOTAL	MW-1B	ug/l	No Trend	0#
CHROMIUM, TOTAL	MW-3A	ug/l	No Trend	0#
CHROMIUM, TOTAL	MW-3B	ug/l	No Trend	0.1172#
CHROMIUM, TOTAL	MW-4A	ug/l	No Trend	0#
CHROMIUM, TOTAL	MW-4B	ug/l	No Trend	0#
CHROMIUM, TOTAL	MW-5A	ug/l	No Trend	0#
CHROMIUM, TOTAL	MW-5B	ug/l	No Trend	0#
CHROMIUM, TOTAL	MW-5C	ug/l	Upward	0.5335#
CHROMIUM, TOTAL	MW-5D	ug/l	No Trend	0.1483#
CYANIDE	MW-1A	ug/l	No Trend	0#
CYANIDE	MW-1B	ug/l	No Trend	0#
CYANIDE	MW-3A	ug/l	No Trend	0#
CYANIDE	MW-3B	ug/l	No Trend	0#
CYANIDE	MW-4A	ug/l	No Trend	0#
CYANIDE	MW-4B	ug/l	No Trend	0#
CYANIDE	MW-5A	ug/l	No Trend	0#
CYANIDE	MW-5B	ug/l	Upward	0.3761#
CYANIDE	MW-5C	ug/l	No Trend	0#
CYANIDE	MW-5D	ug/l	No Trend	0#
MERCURY	MW-1A	ug/l	No Trend	0#
MERCURY	MW-1B	ug/l	No Trend	0#
MERCURY	MW-3A	ug/l	No Trend	0#
MERCURY	MW-3B	ug/l	No Trend	0#
MERCURY	MW-4A	ug/l	No Trend	0#
MERCURY	MW-4B	ug/l	No Trend	0#
MERCURY	MW-5A	ug/l	No Trend	0#
MERCURY	MW-5B	ug/l	No Trend	0#

means trend coefficient of log-transformed data. Log(2) times reciprocal is doubling(+)/halving(-) time.

Statistical Note: ND surrogate = 0.5 X Median of Nondetects' PQLs.&R

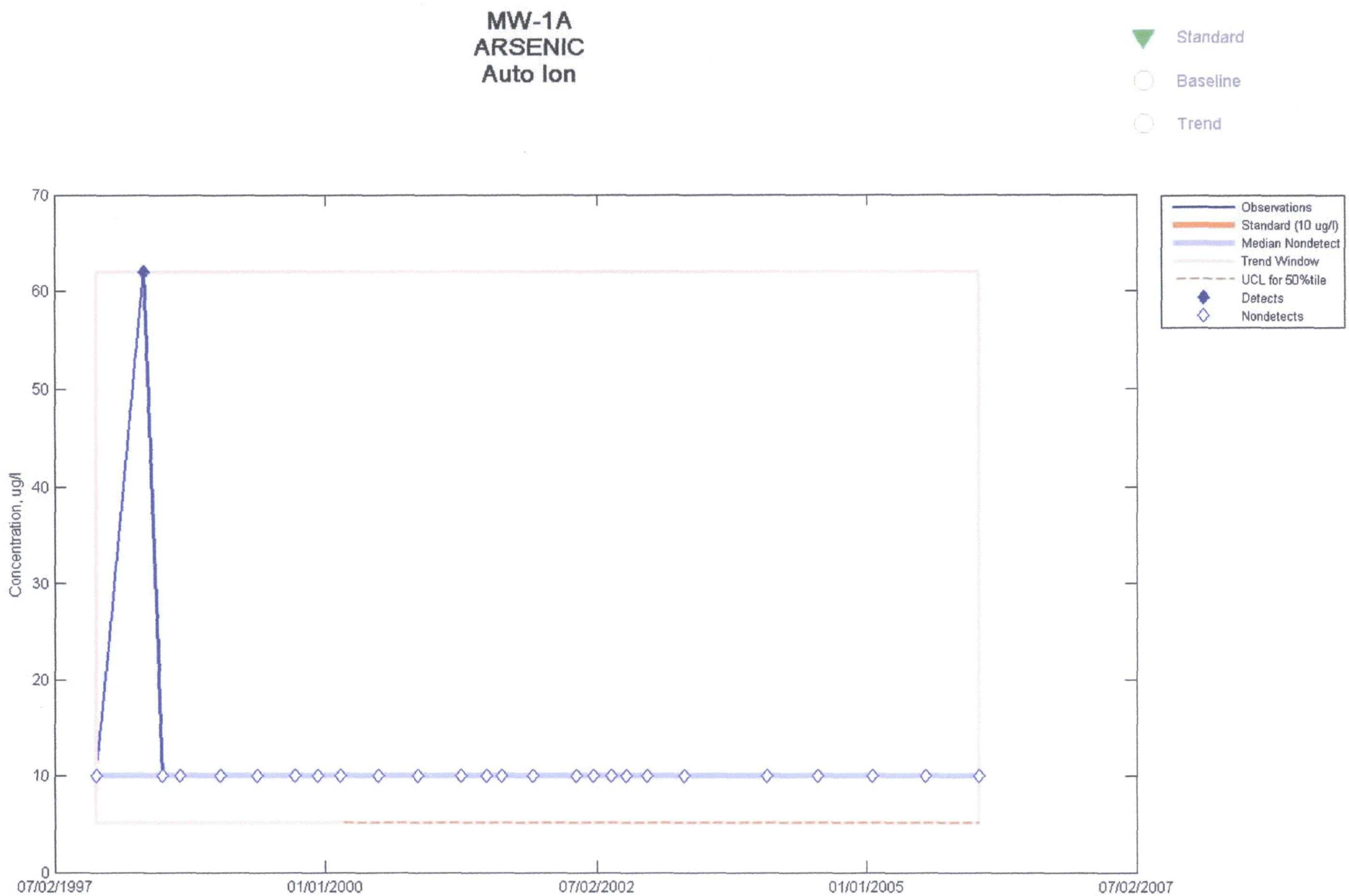
Results created on 29-Jun-2006.

Auto Ion				
MERCURY	MW-5C	ug/l	No Trend	0#
MERCURY	MW-5D	ug/l	No Trend	0#
NICKEL	MW-1A	ug/l	No Trend	0#
NICKEL	MW-1B	ug/l	No Trend	0#
NICKEL	MW-3A	ug/l	No Trend	0#
NICKEL	MW-3B	ug/l	Upward	0.02711#
NICKEL	MW-4A	ug/l	Downward	-0.02809#
NICKEL	MW-4B	ug/l	Upward	0.05359#
NICKEL	MW-5A	ug/l	Downward	-0.09121#
NICKEL	MW-5B	ug/l	No Trend	-0.068#
NICKEL	MW-5C	ug/l	Downward	-0.05112#
NICKEL	MW-5D	ug/l	No Trend	-0.007455#
TRICHLOROETHYLENE (TCE)	MW-1A	ug/l	No Trend	0#
TRICHLOROETHYLENE (TCE)	MW-1B	ug/l	No Trend	0#
TRICHLOROETHYLENE (TCE)	MW-3A	ug/l	No Trend	0#
TRICHLOROETHYLENE (TCE)	MW-3B	ug/l	No Trend	0#
TRICHLOROETHYLENE (TCE)	MW-4A	ug/l	No Trend	0#
TRICHLOROETHYLENE (TCE)	MW-4B	ug/l	No Trend	0#
TRICHLOROETHYLENE (TCE)	MW-5A	ug/l	No Trend	0#
TRICHLOROETHYLENE (TCE)	MW-5B	ug/l	No Trend	0#
TRICHLOROETHYLENE (TCE)	MW-5C	ug/l	Downward	-0.1574#
TRICHLOROETHYLENE (TCE)	MW-5D	ug/l	Upward	0.03964#
VINYL CHLORIDE	MW-1A	ug/l	No Trend	0#
VINYL CHLORIDE	MW-1B	ug/l	No Trend	0#
VINYL CHLORIDE	MW-3A	ug/l	No Trend	0#
VINYL CHLORIDE	MW-3B	ug/l	No Trend	0#
VINYL CHLORIDE	MW-4A	ug/l	No Trend	-0.1159#
VINYL CHLORIDE	MW-4B	ug/l	No Trend	0#
VINYL CHLORIDE	MW-5A	ug/l	Downward	-0.06037#
VINYL CHLORIDE	MW-5B	ug/l	No Trend	-0.1245#
VINYL CHLORIDE	MW-5C	ug/l	Downward	-0.1533#
VINYL CHLORIDE	MW-5D	ug/l	No Trend	0#
ZINC	MW-1A	ug/l	No Trend	0#
ZINC	MW-1B	ug/l	No Trend	-0.005854#
ZINC	MW-3A	ug/l	No Trend	0#
ZINC	MW-3B	ug/l	No Trend	0#
ZINC	MW-4A	ug/l	No Trend	0#
ZINC	MW-4B	ug/l	Downward	-0.1105#
ZINC	MW-5A	ug/l	No Trend	0#
ZINC	MW-5B	ug/l	No Trend	0#
ZINC	MW-5C	ug/l	Downward	-0.1228#
ZINC	MW-5D	ug/l	No Trend	0#

means trend coefficient of log-transformed data. Log(2) times reciprocal is doubling(+)/halving(-) time.

Statistical Note: ND surrogate = 0.5 X Median of Nondetects' PQLs.&R

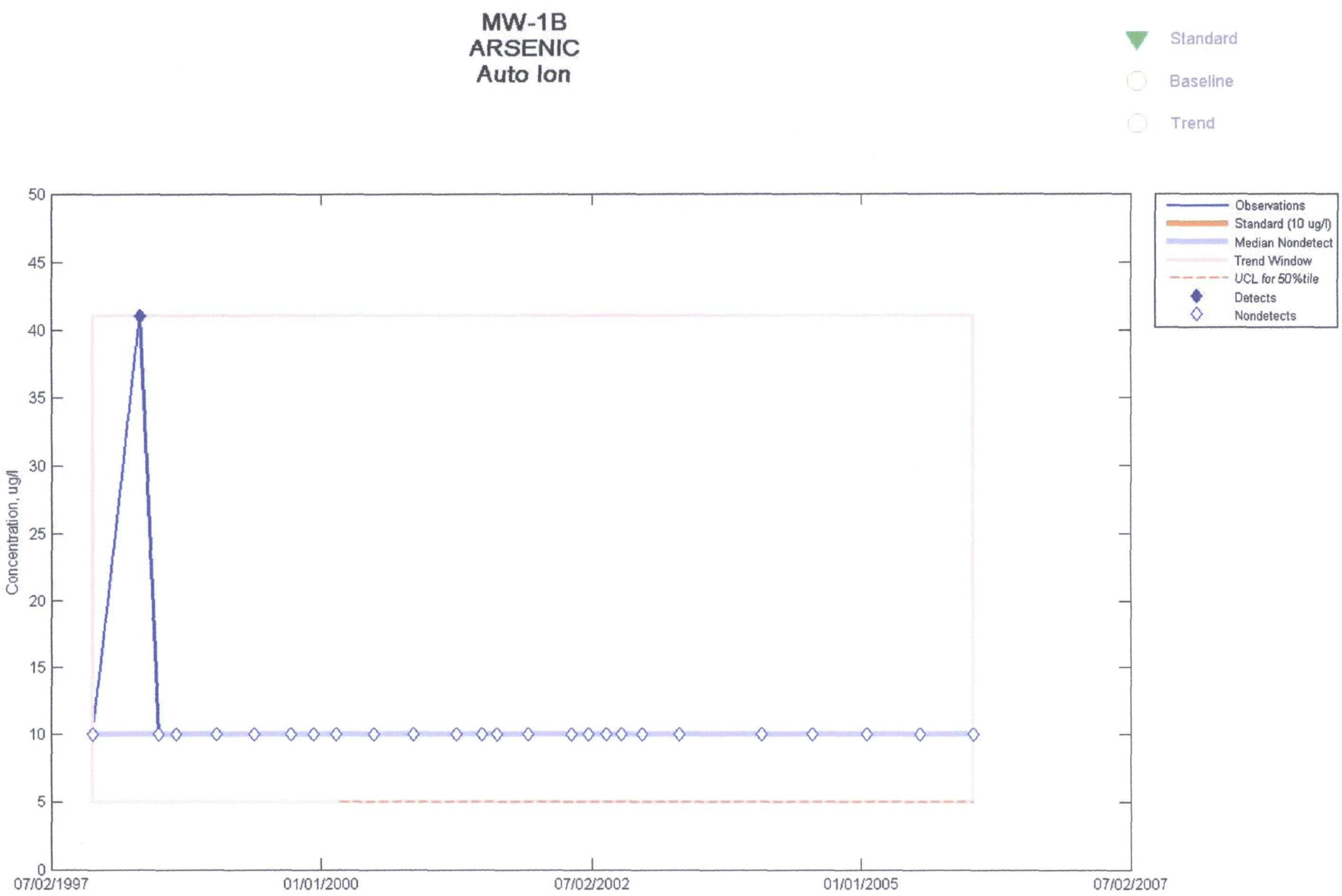
Results created on 29-Jun-2006.



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

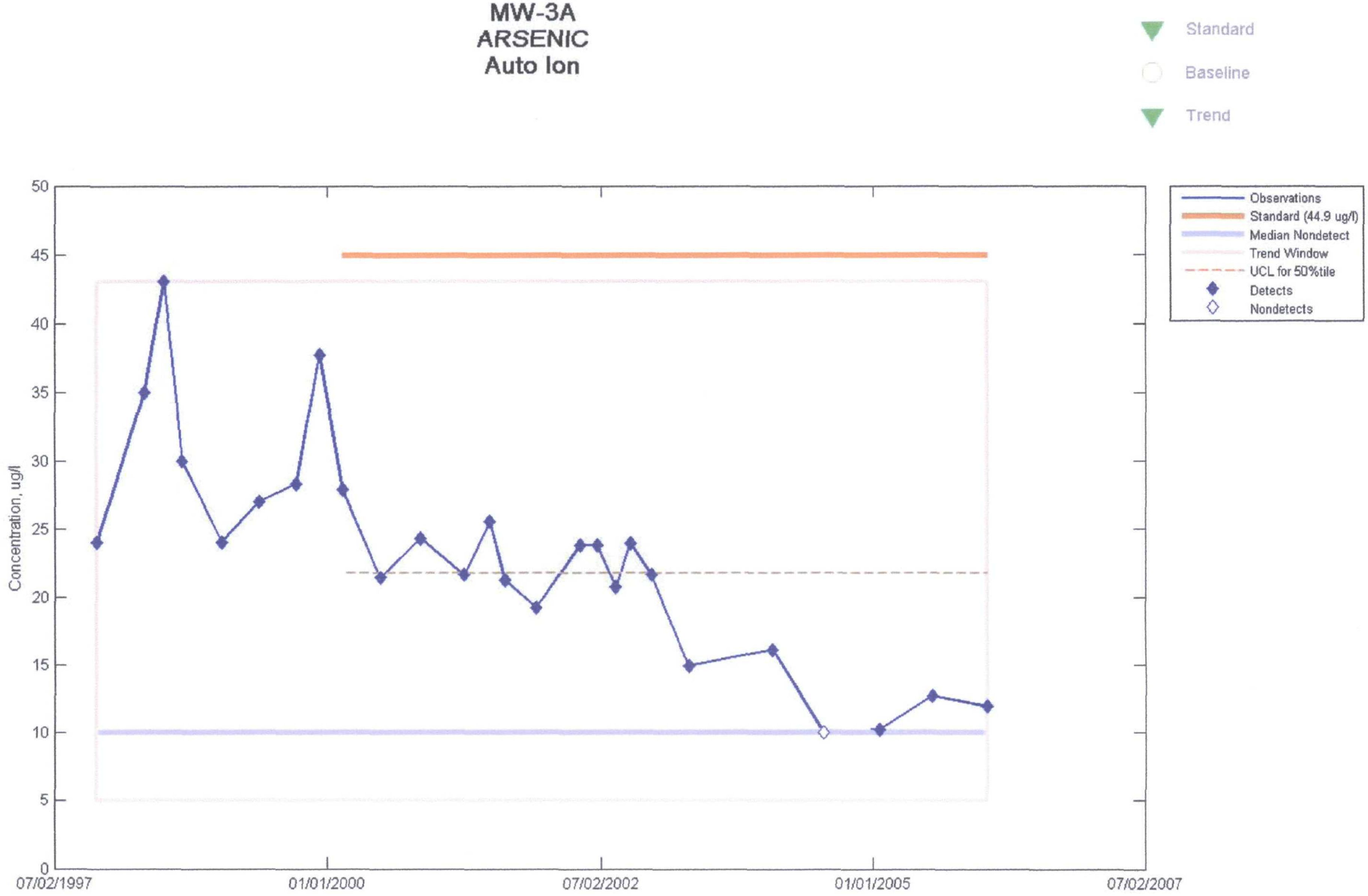


Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-3A
ARSENIC
Auto Ion

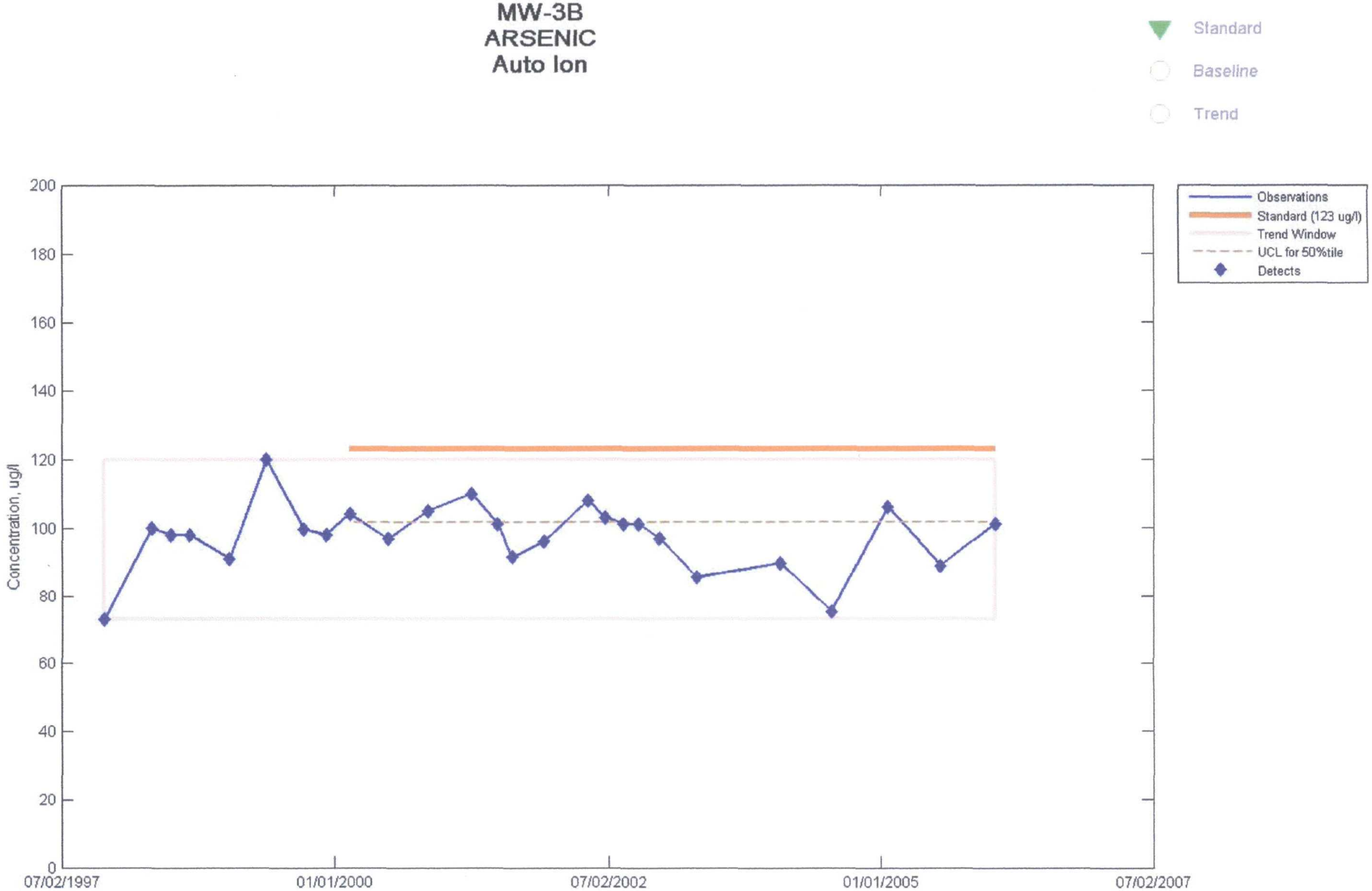


Standard Test (95%): Compliance <UCL = 2.17e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -2.71e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-3B
ARSENIC
Auto Ion

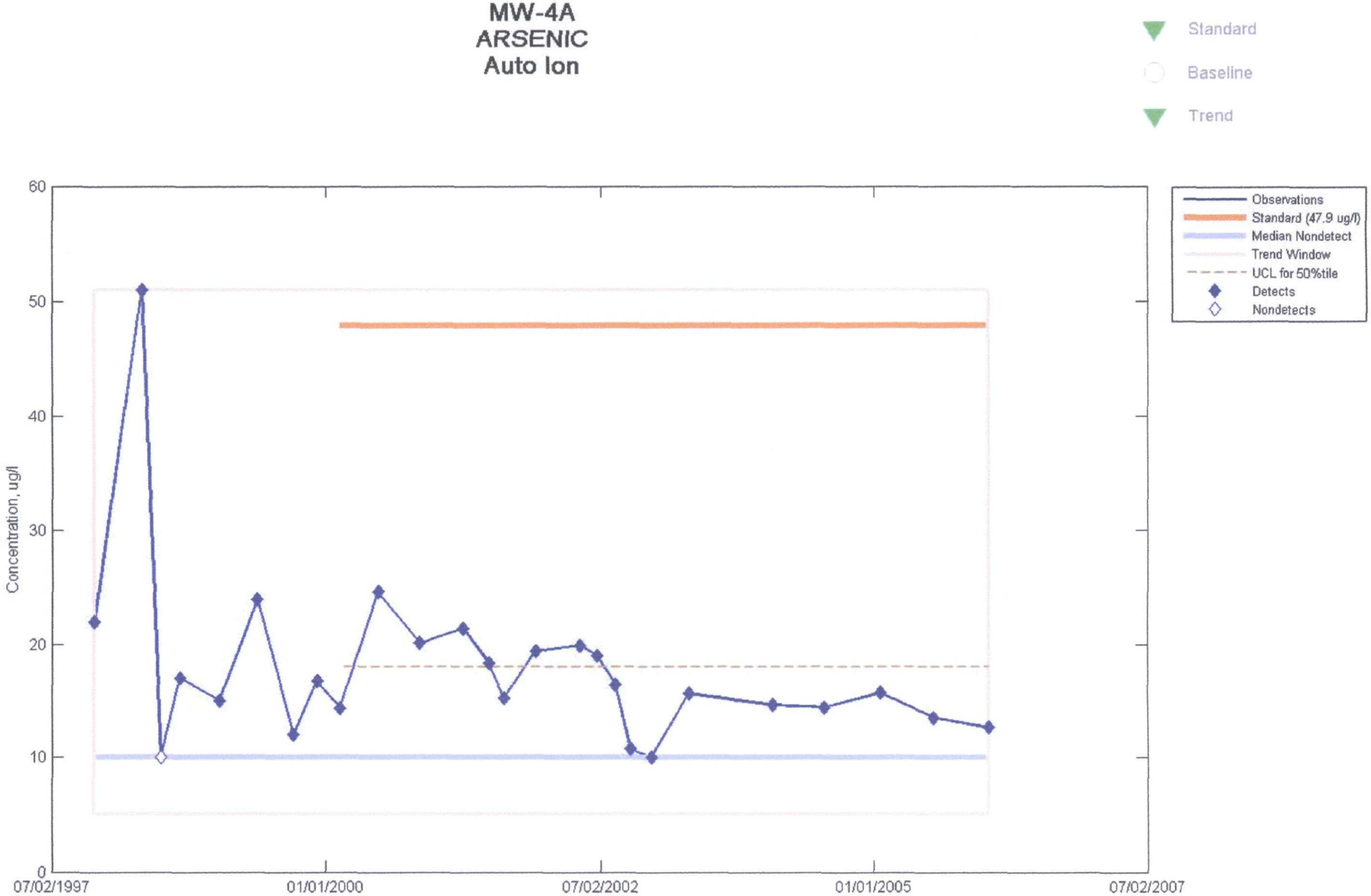


Standard Test (95%): Compliance <UCL = 1.01e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = -4.30e-001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-4A
ARSENIC
Auto Ion

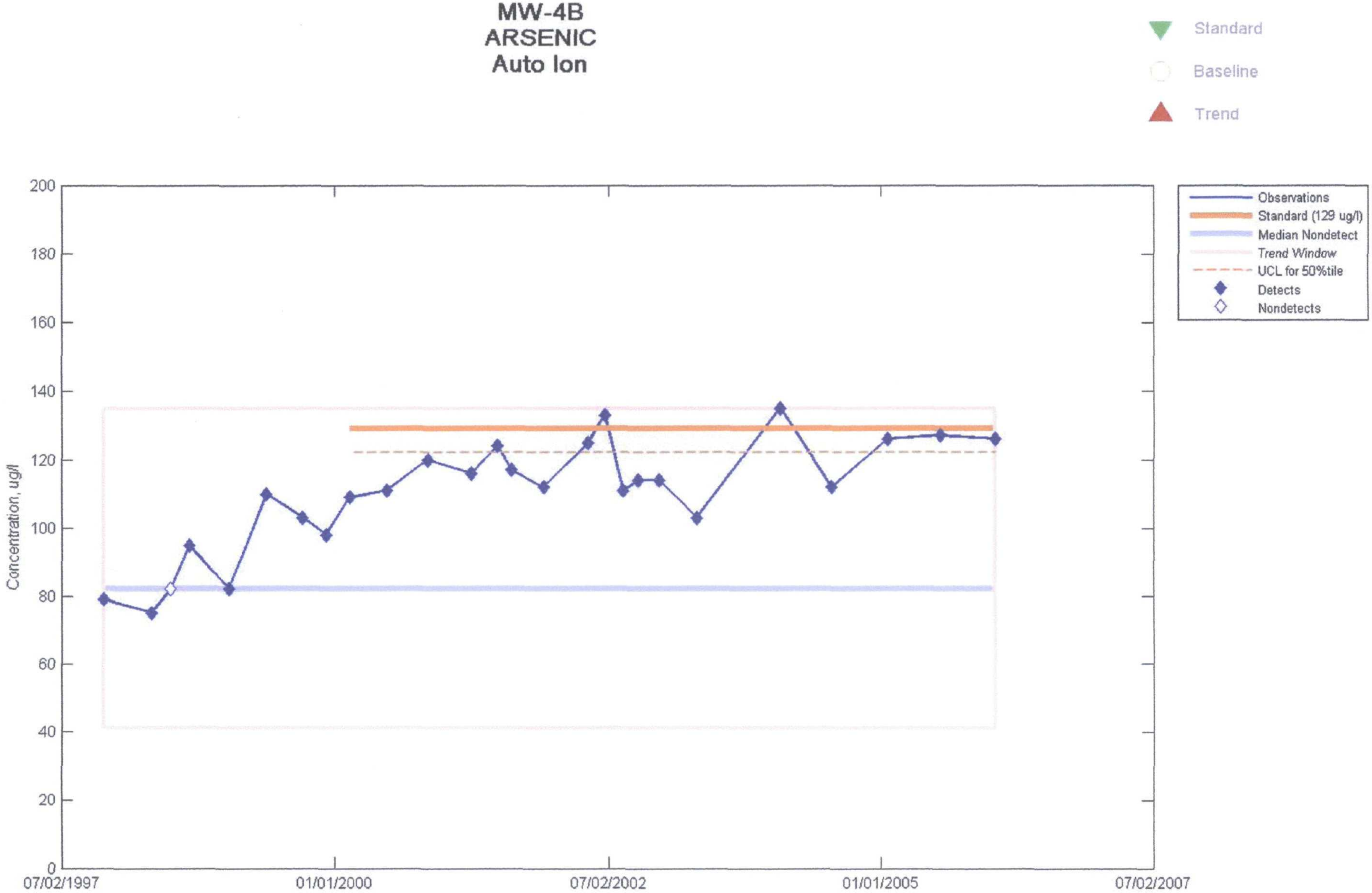


Standard Test (95%): Compliance <UCL = 1.80e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -1.05e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-4B
ARSENIC
Auto Ion



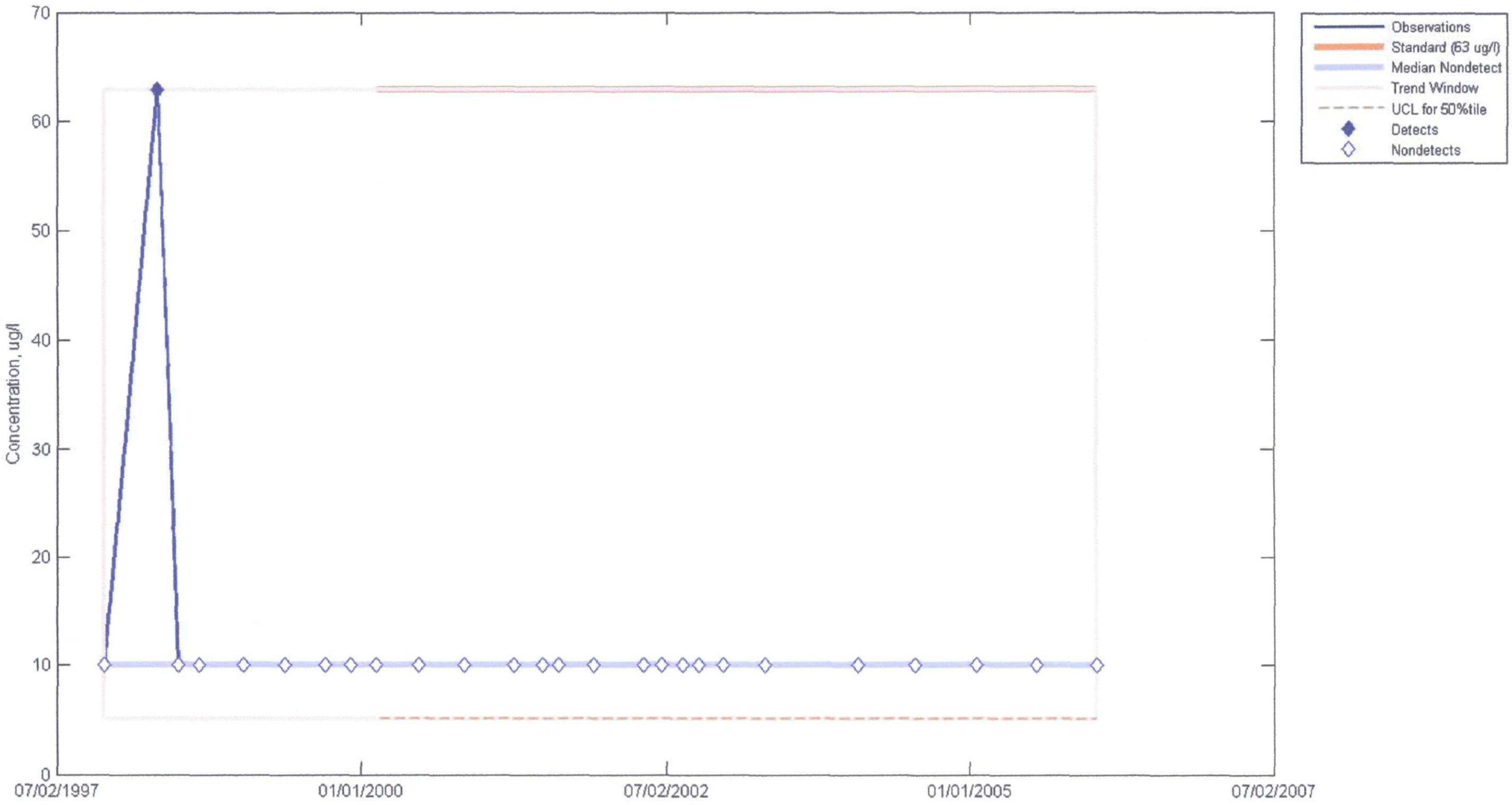
Standard Test (95%): Compliance <UCL = 1.22e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Upward <Slope = 5.49e+000 ug/l/year>

Run Date: 13-Jun-2006
Prepared by: USEPA

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

MW-5A
ARSENIC
Auto Ion

Standard
Baseline
Trend

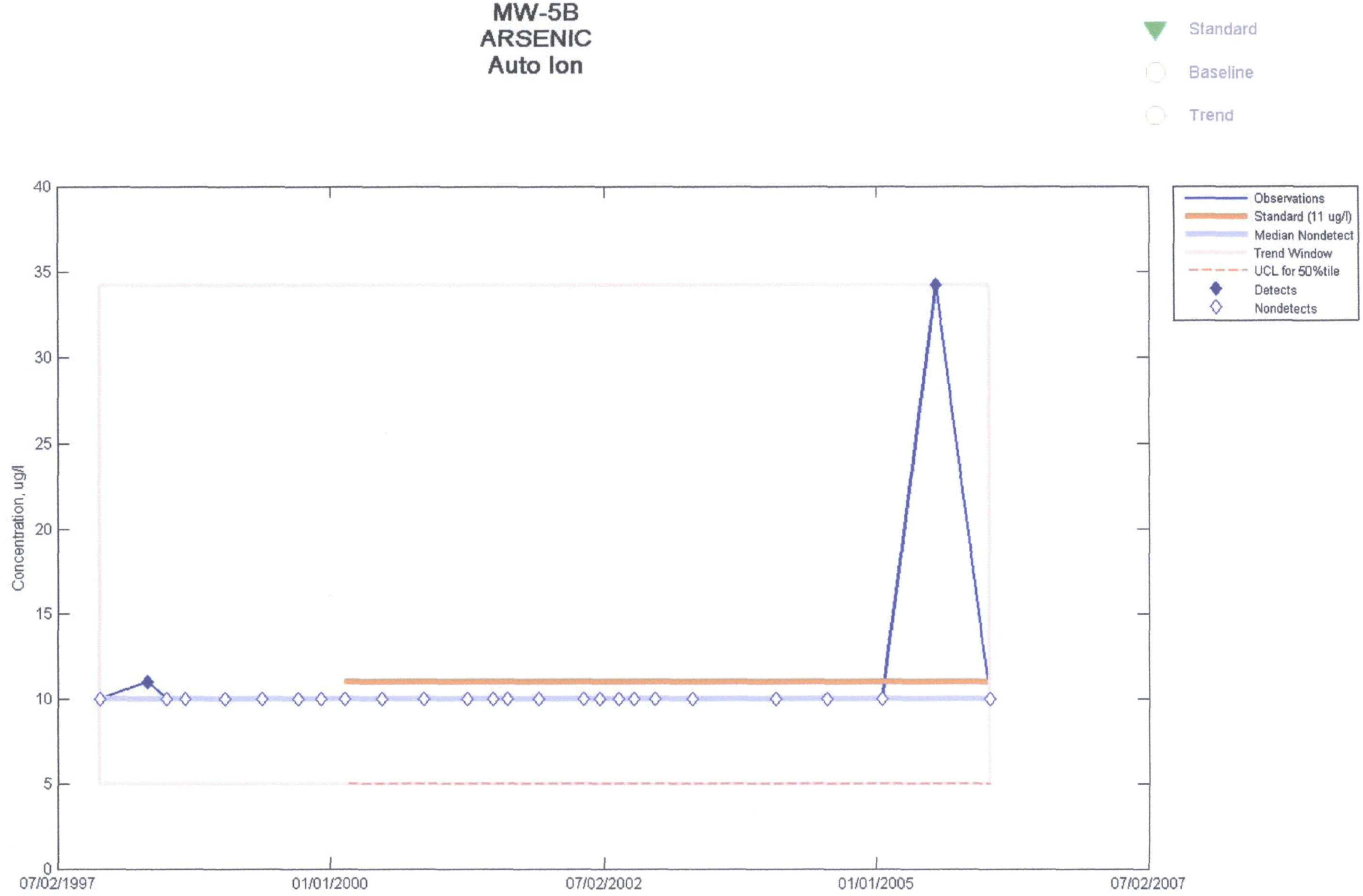


Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

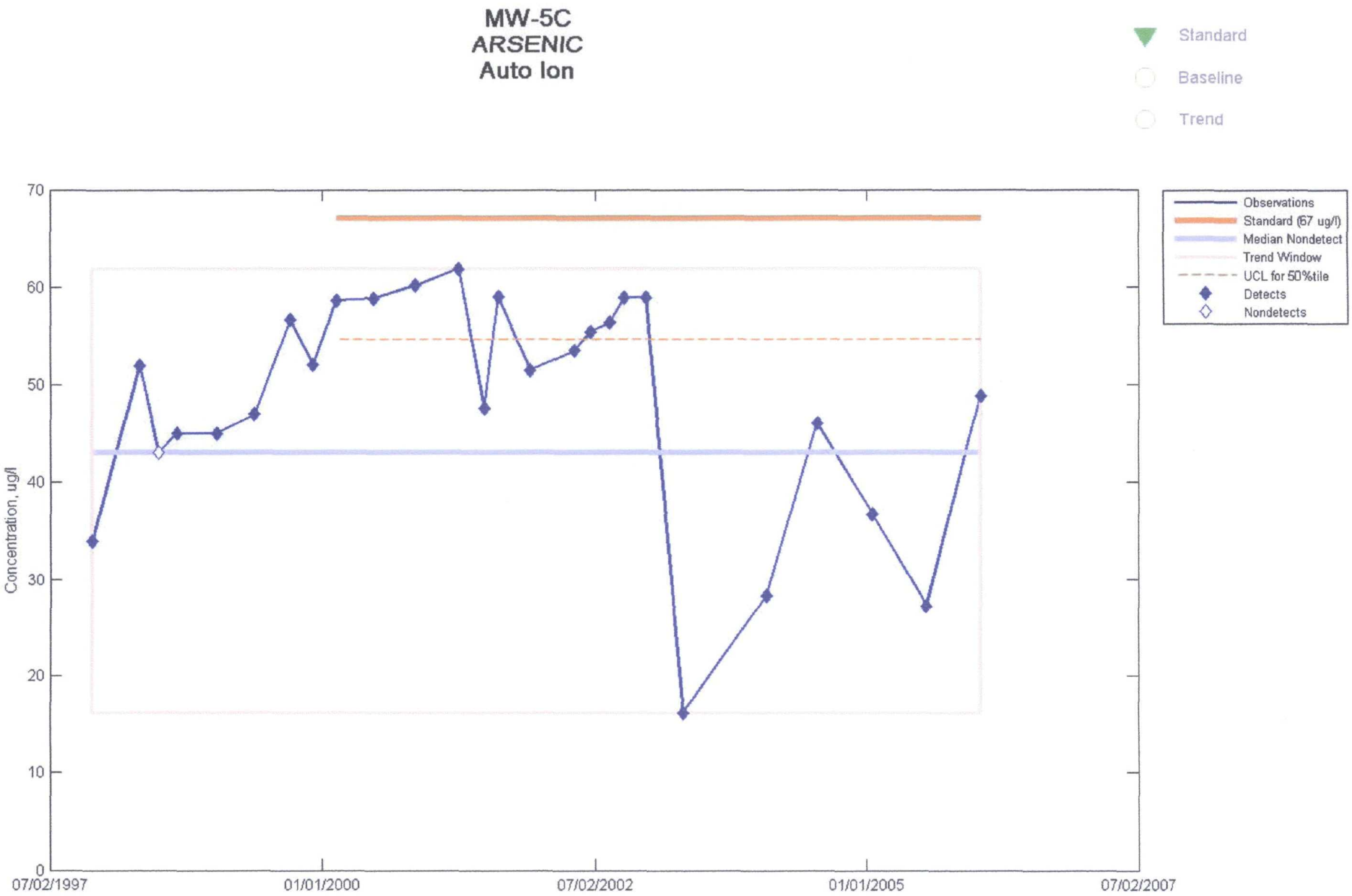
MW-5B
ARSENIC
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

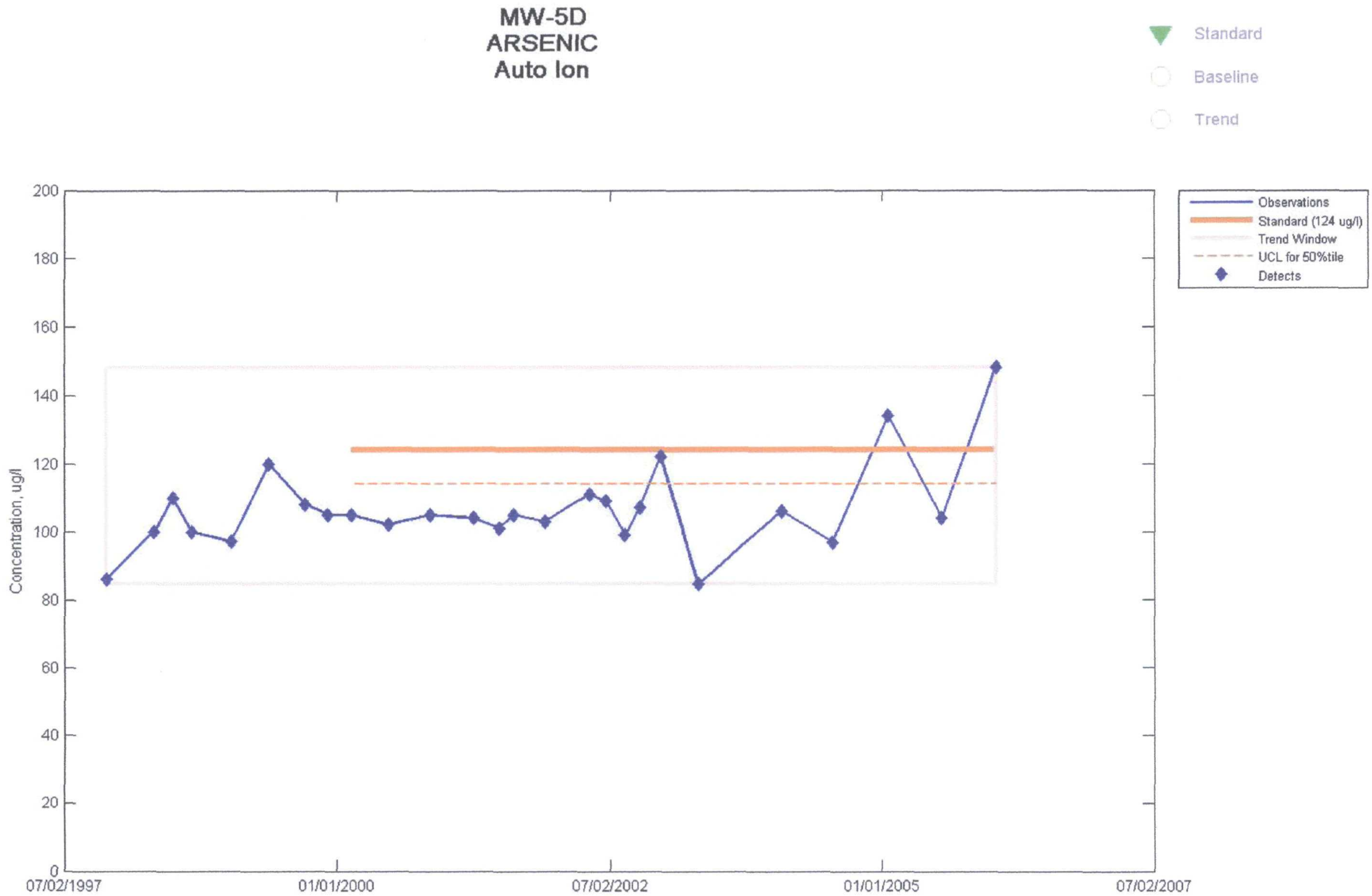
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 5.46e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 1.06e-001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

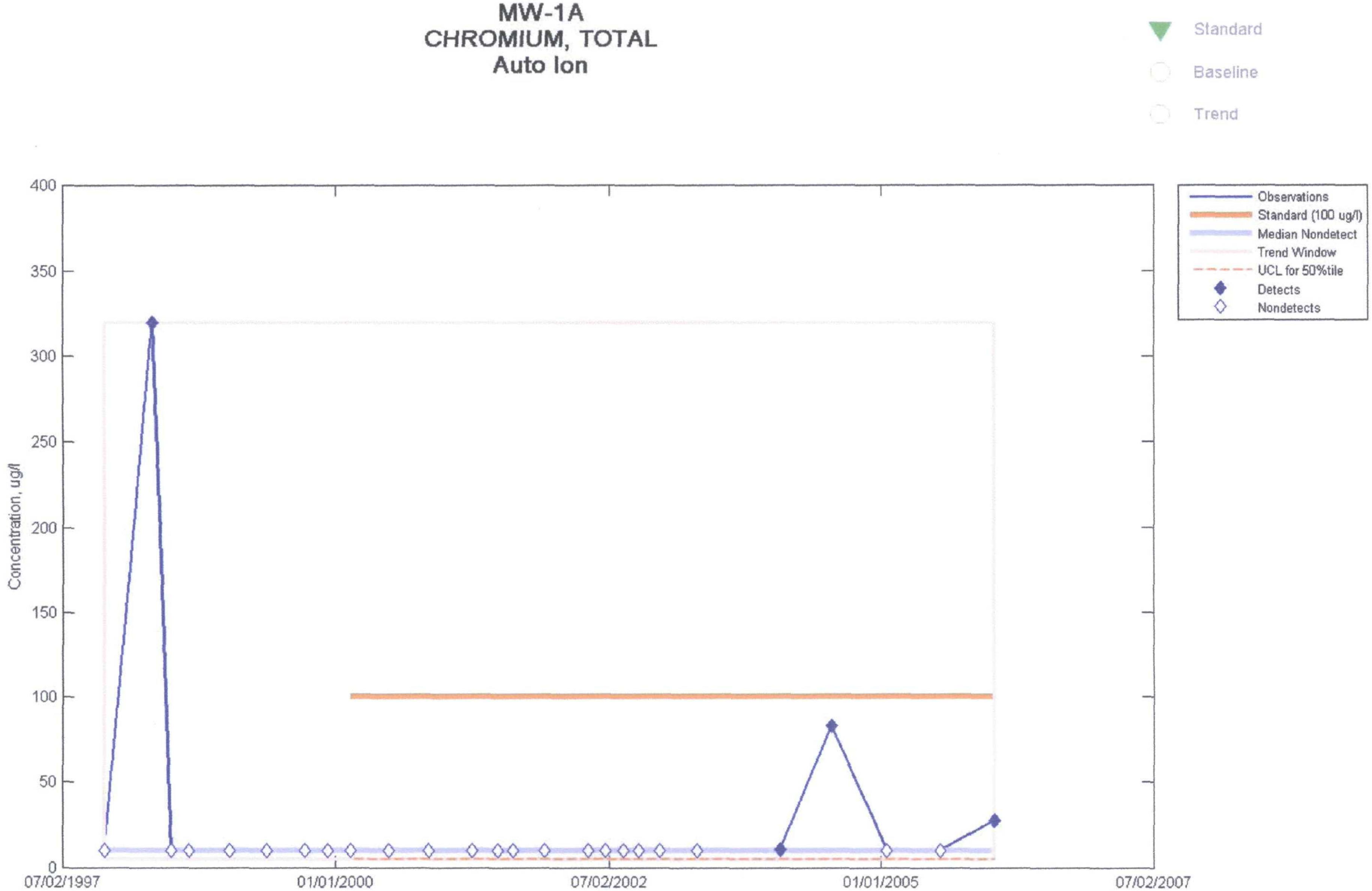


Standard Test (95%): Compliance <UCL = 1.14e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 1.11e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

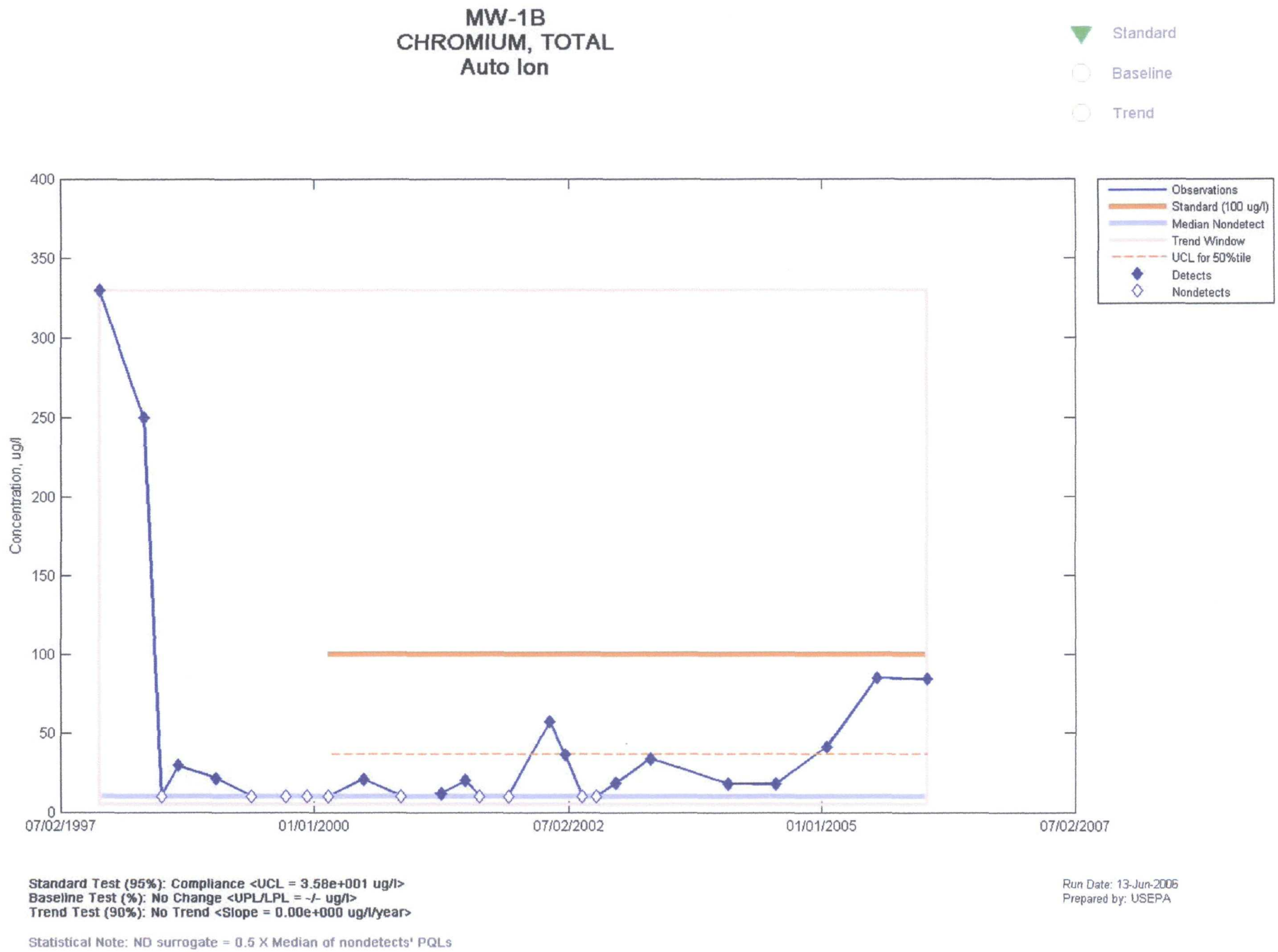
MW-1A
CHROMIUM, TOTAL
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

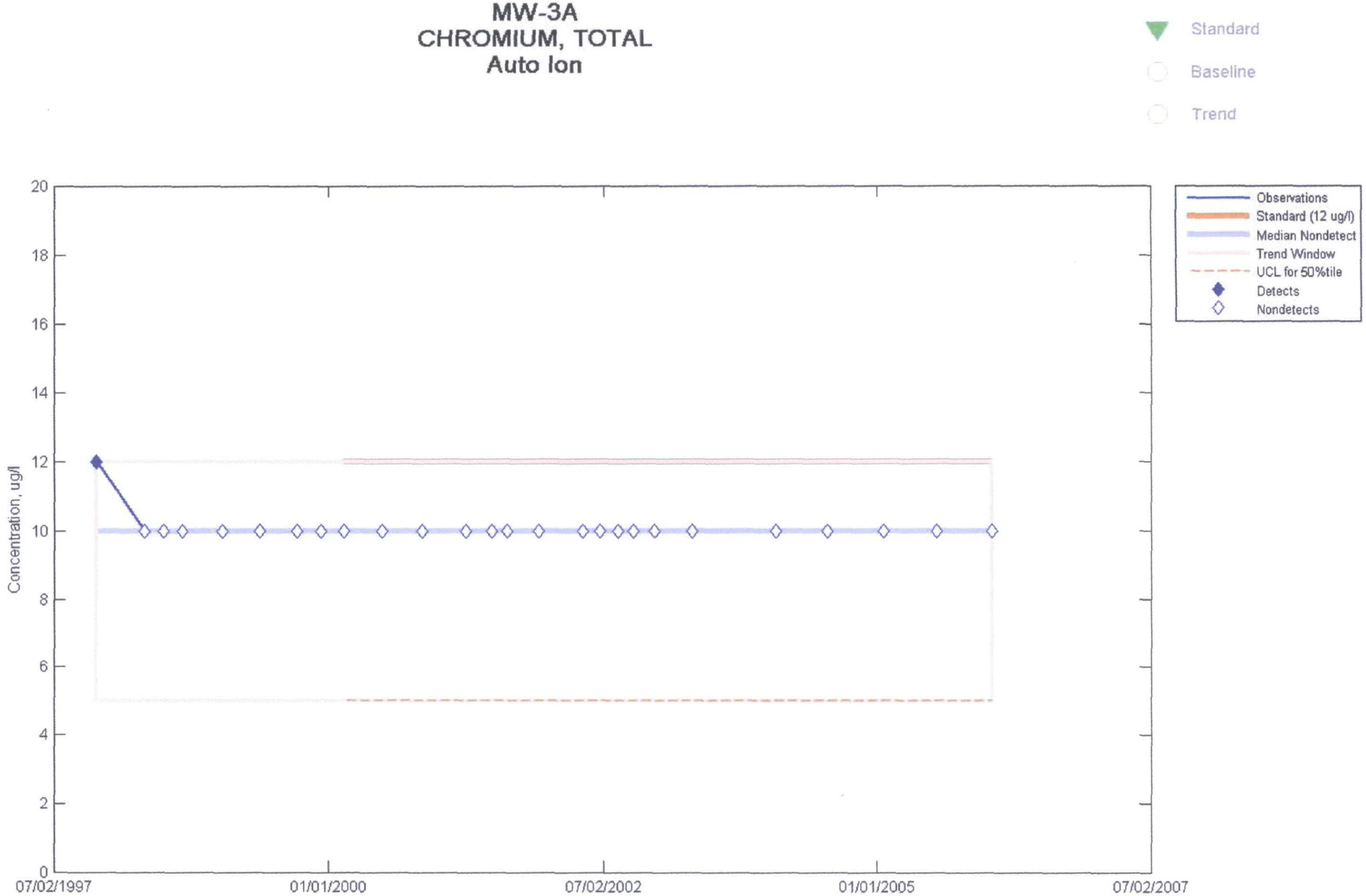
Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA



MW-1B
CHROMIUM, TOTAL
Auto Ion
Standard
Baseline
Trend
Observations
Standard (100 ug/l)
Median Nondetect
Trend Window
UCL for 50%tile
Detects
Nondetects
Concentration, ug/l
400
350
300
250
200
150
100
50
0
07/02/1997
01/01/2000
07/02/2002
01/01/2005
07/02/2007
Standard Test (95%): Compliance <UCL = 3.58e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>
Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs
Run Date: 13-Jun-2006
Prepared by: USEPA

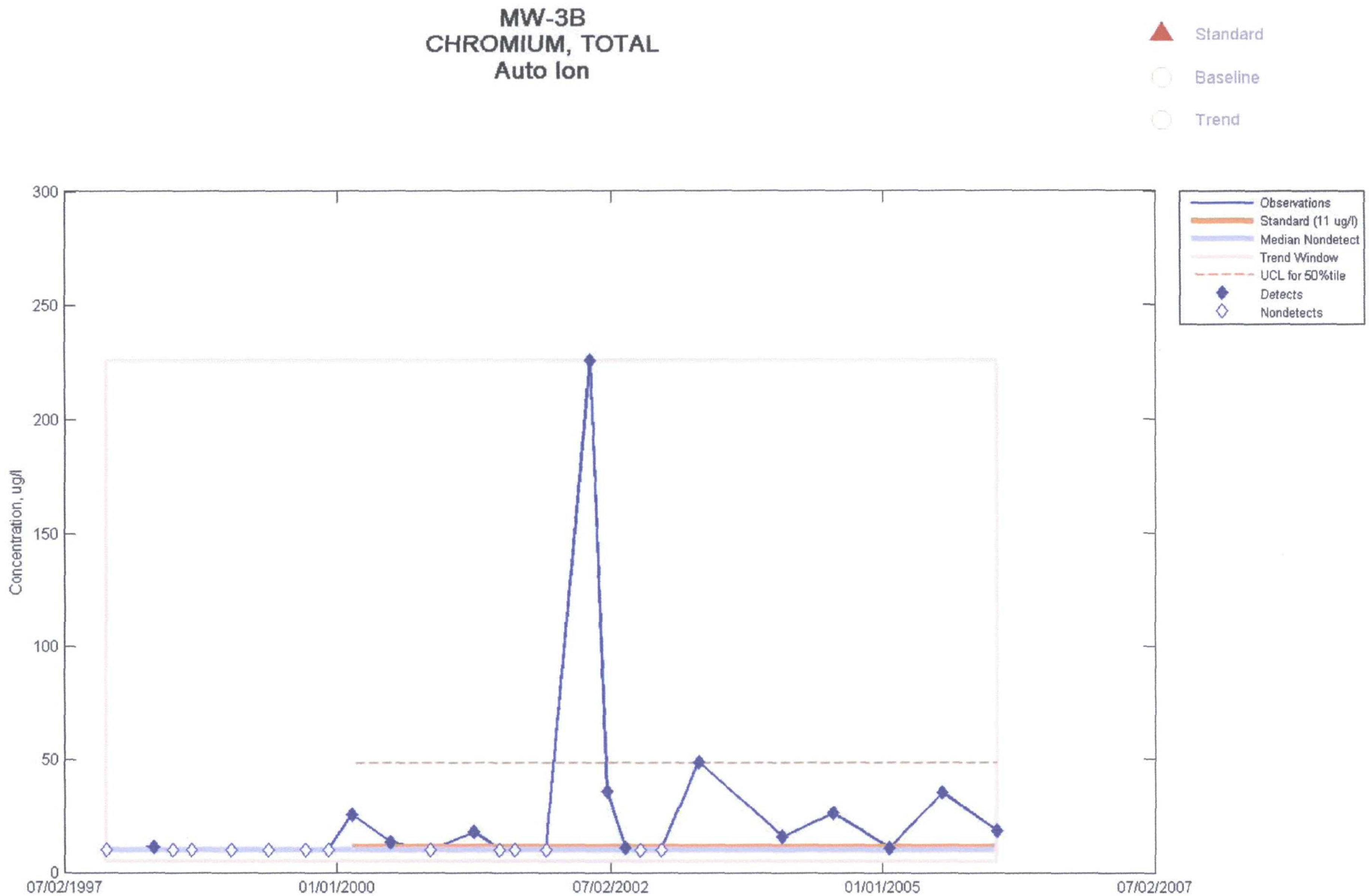
MW-3A
CHROMIUM, TOTAL
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

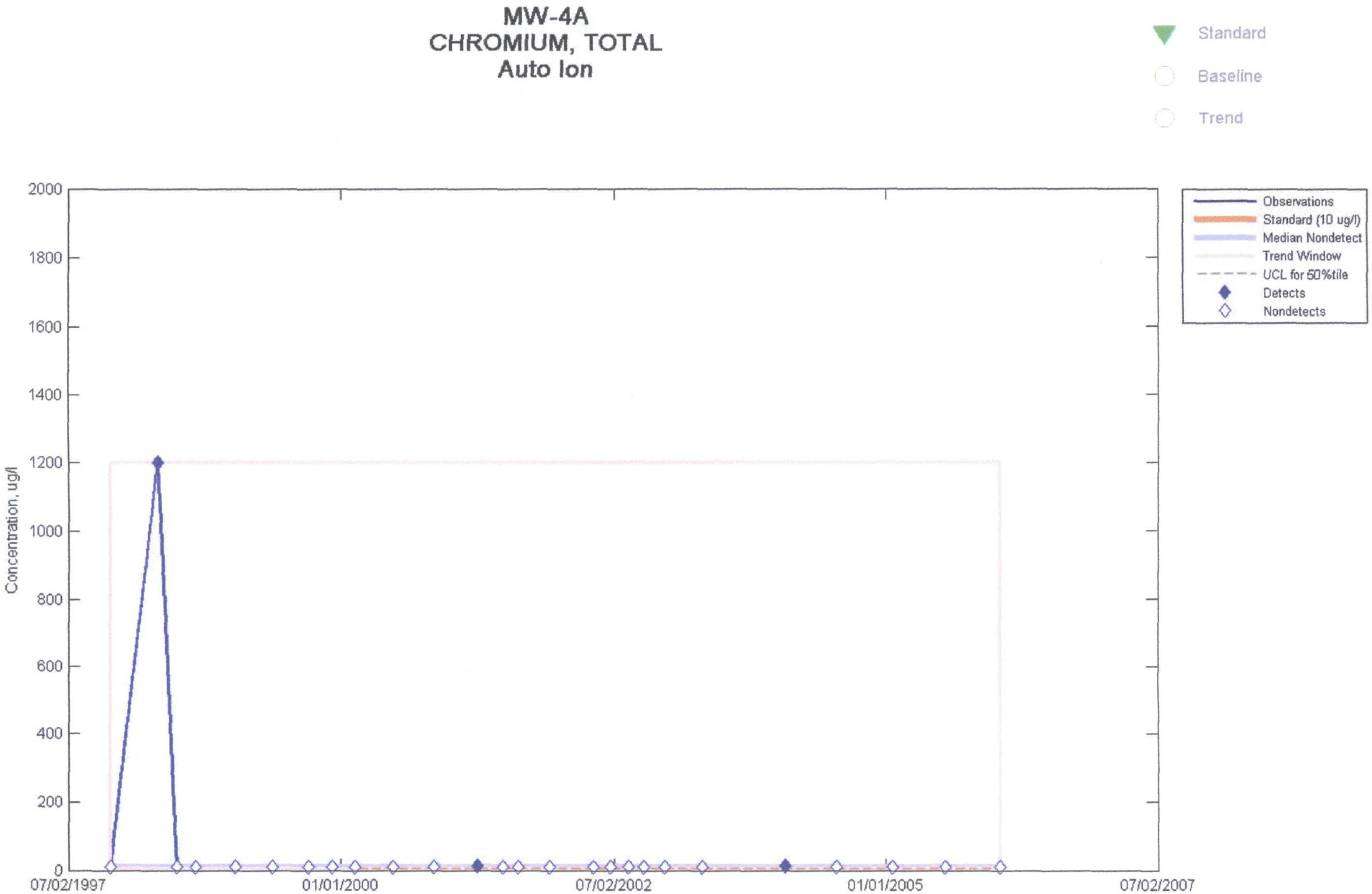
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Exceedance <UCL = 4.82e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 1.07e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

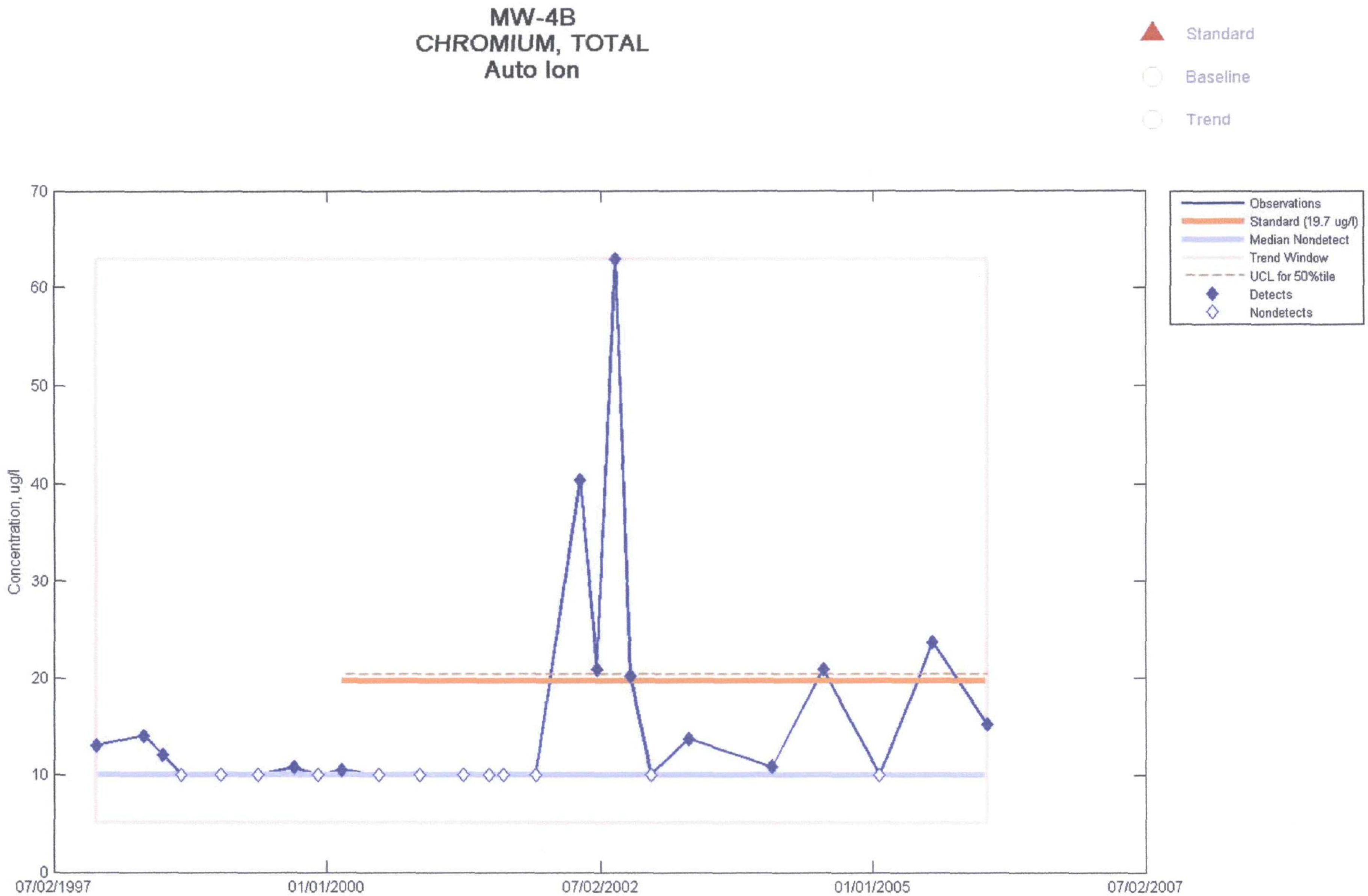
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

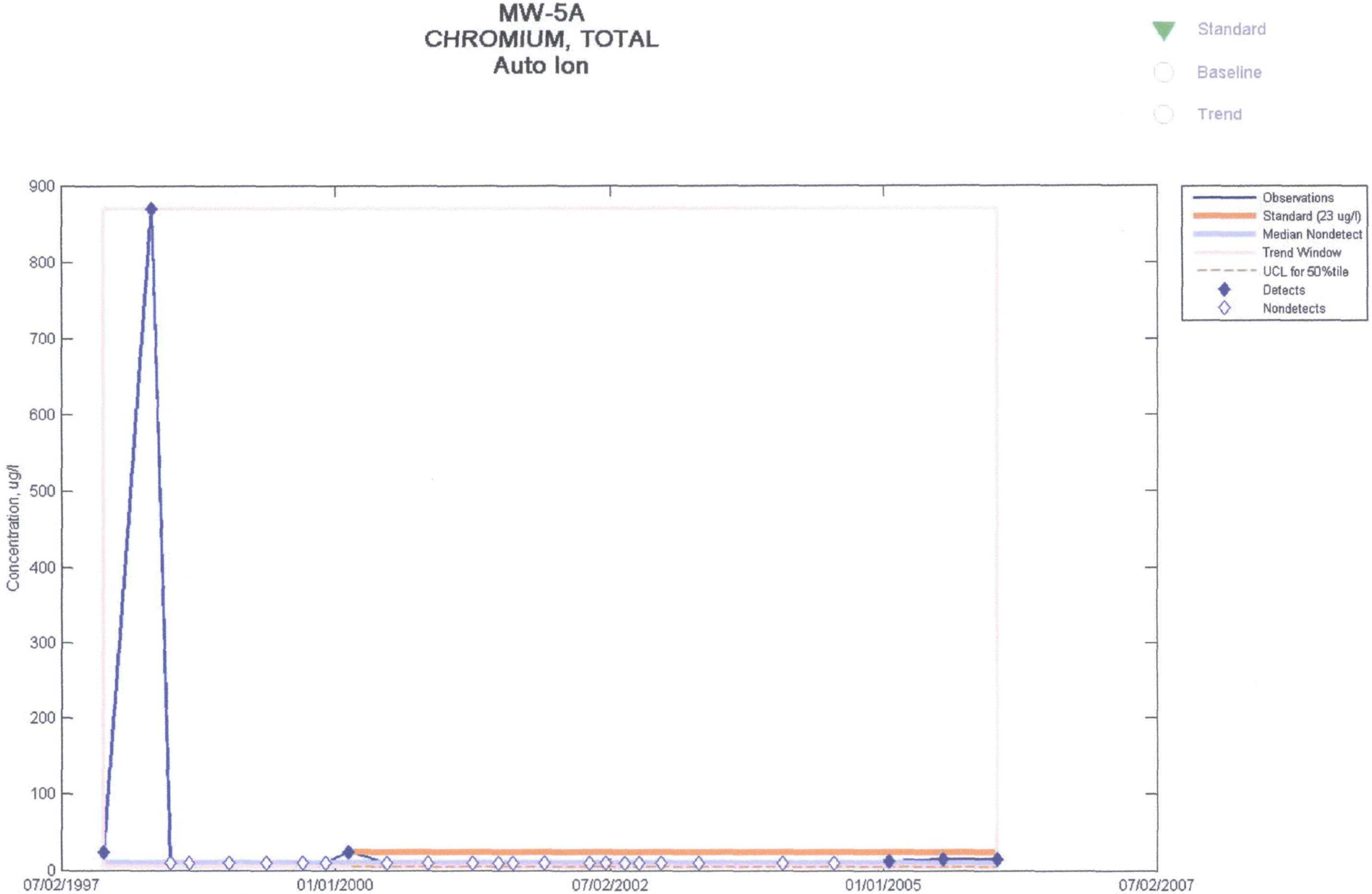


Standard Test (95%): Exceedance <UCL = 2.03e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

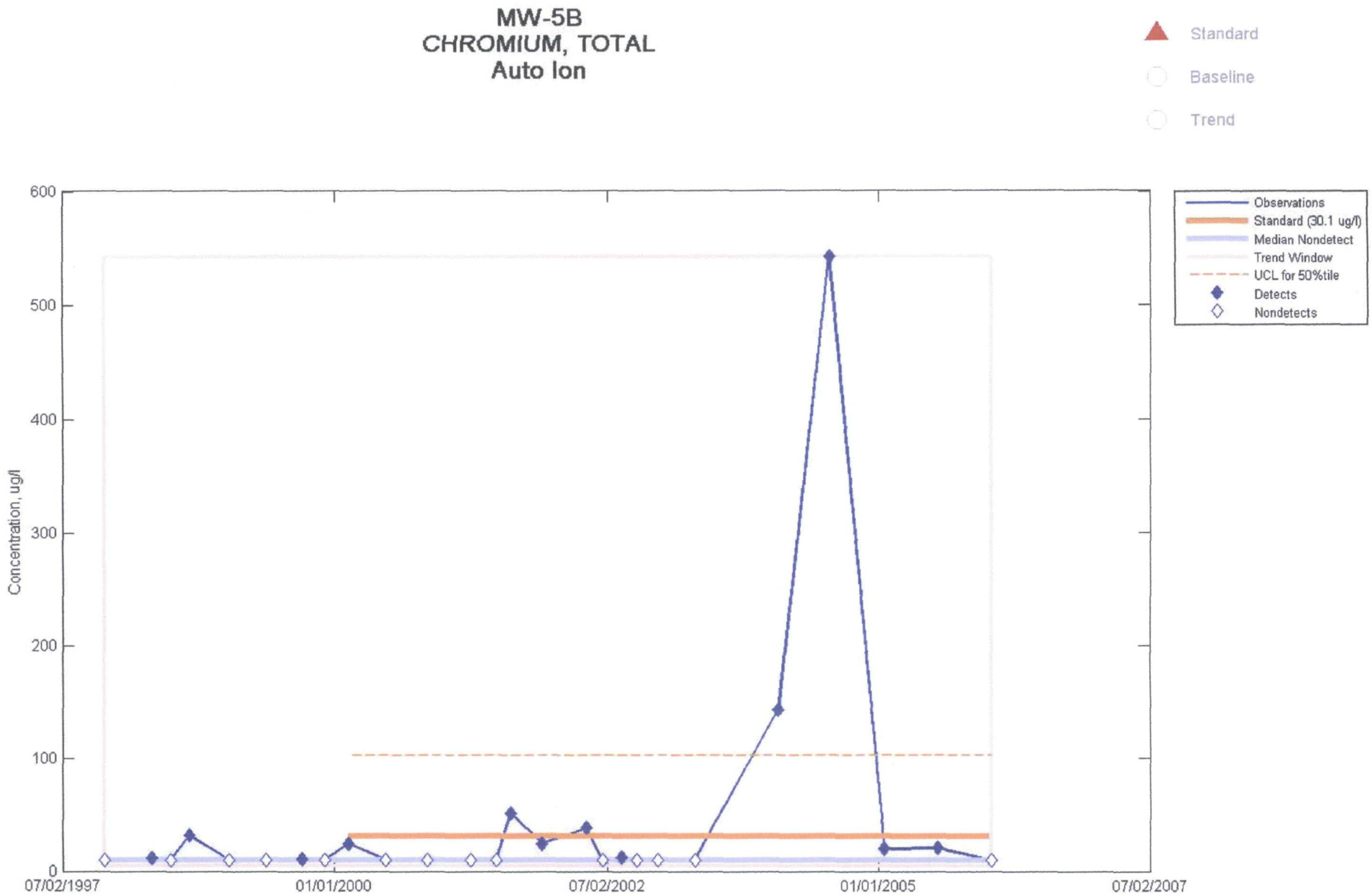
MW-5A
CHROMIUM, TOTAL
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

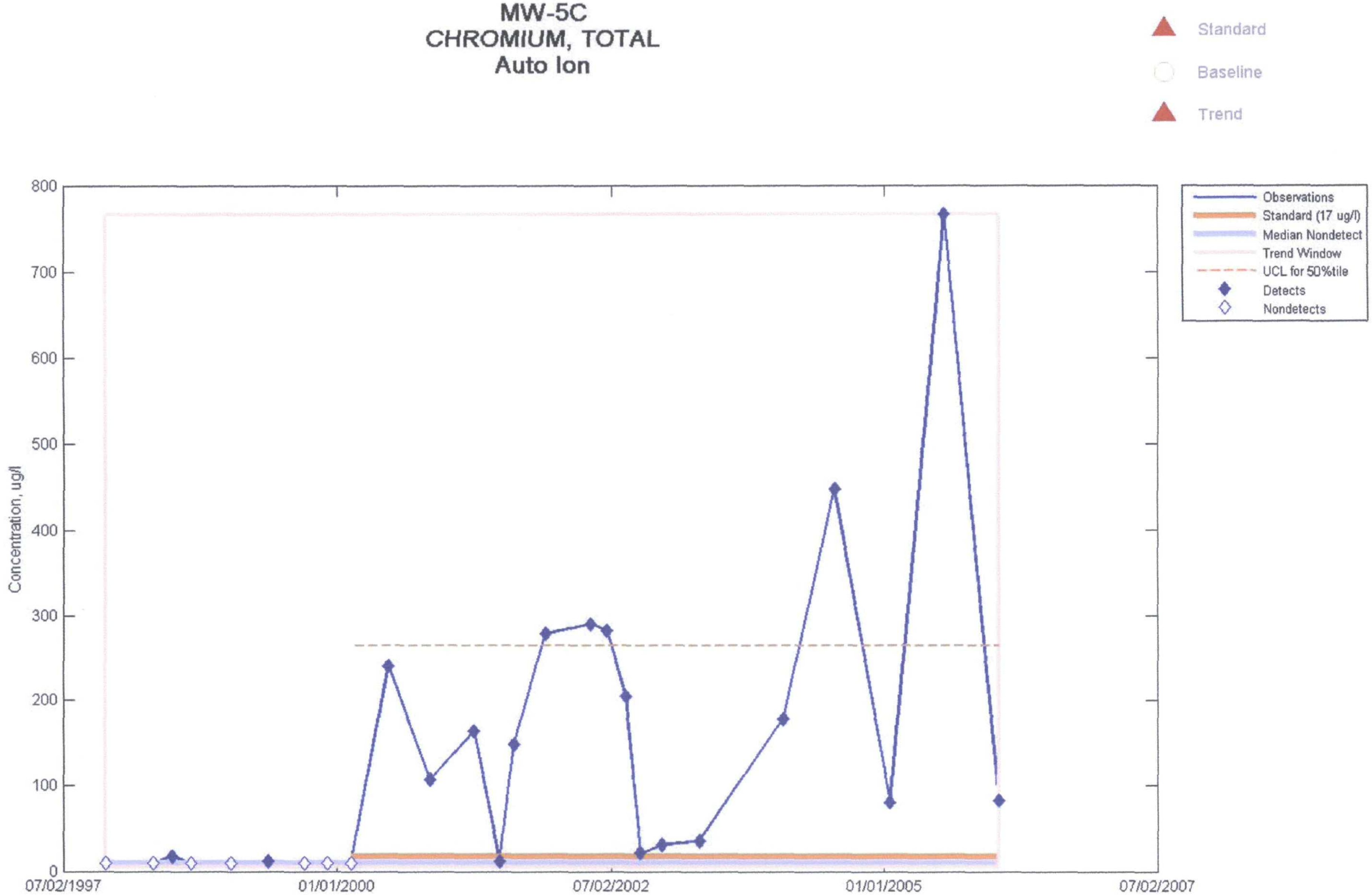


Standard Test (95%): Exceedance <UCL = 1.02e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

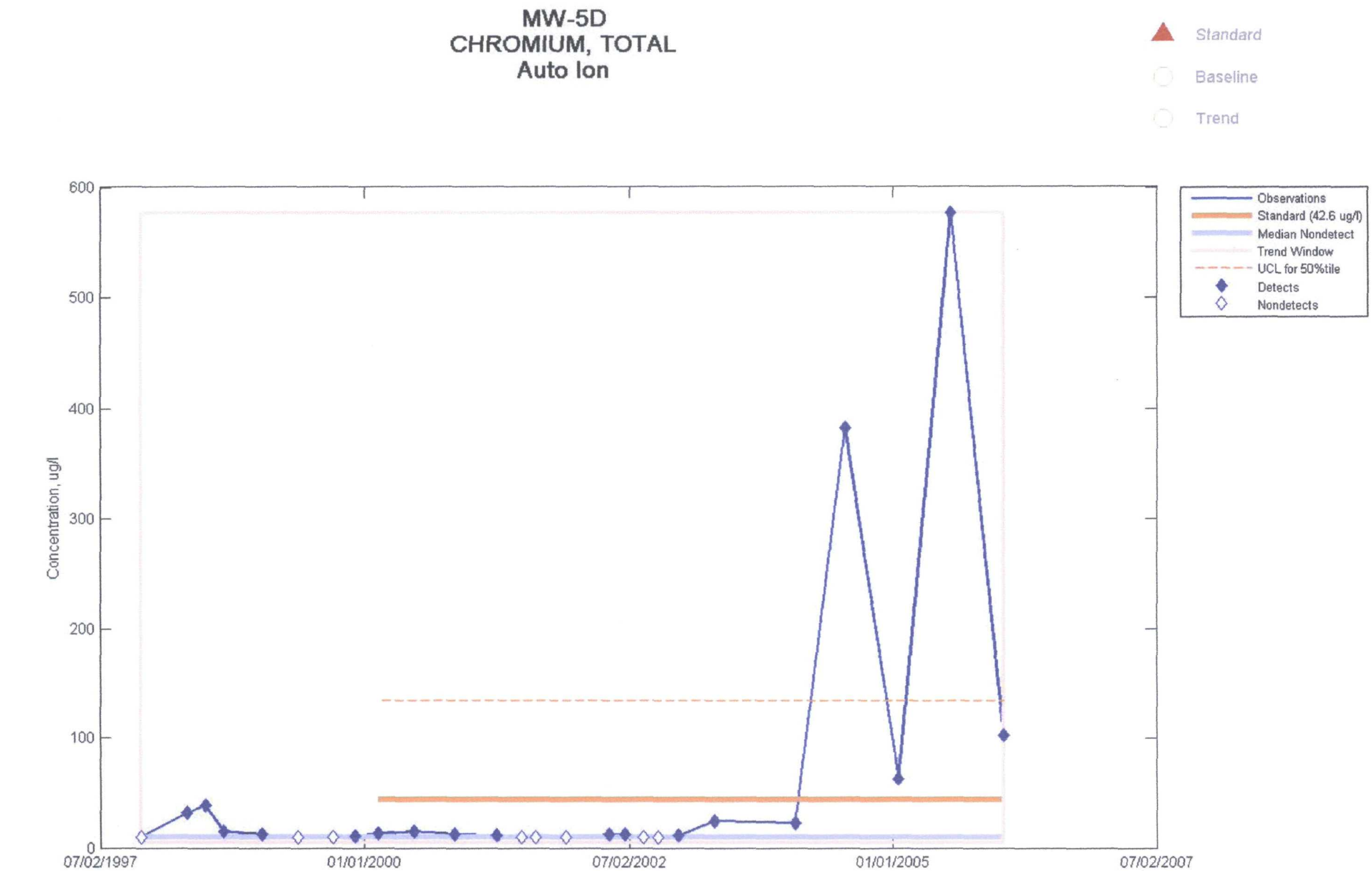
MW-5C
CHROMIUM, TOTAL
Auto Ion



Standard Test (95%): Exceedance <UCL = 2.64e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Upward <Slope = 1.97e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

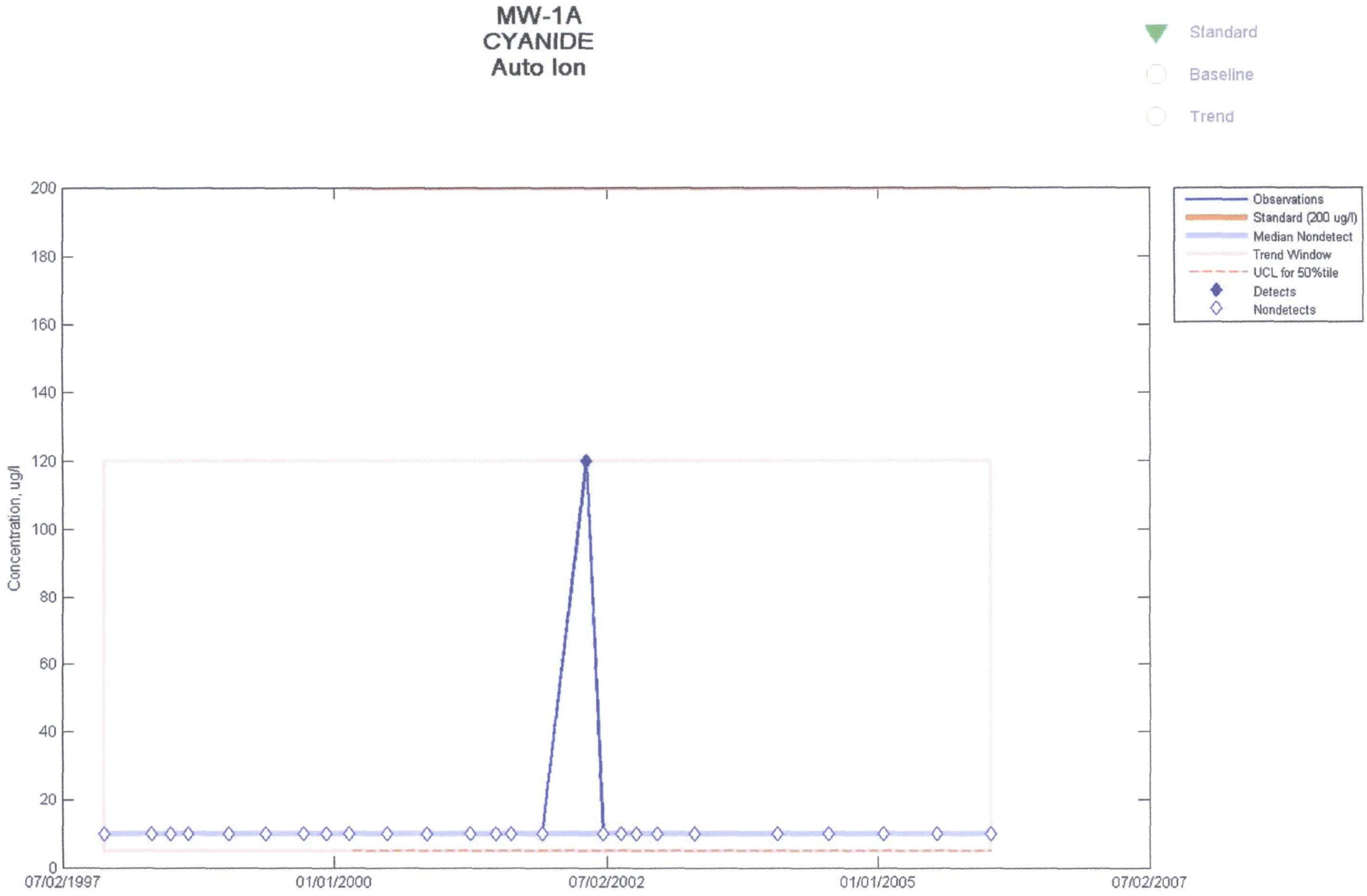
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Exceedance <UCL = 1.34e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 2.02e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

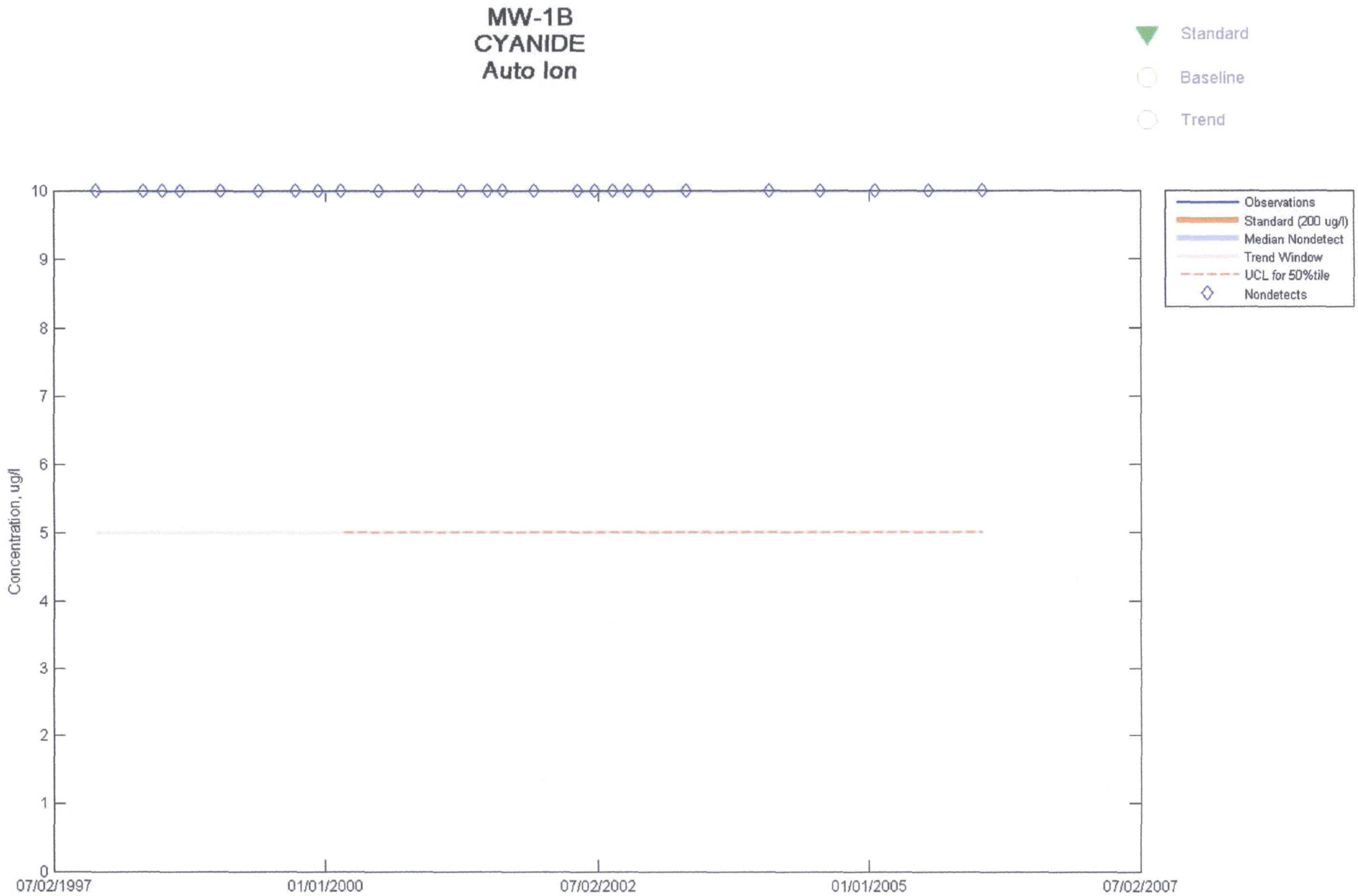
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

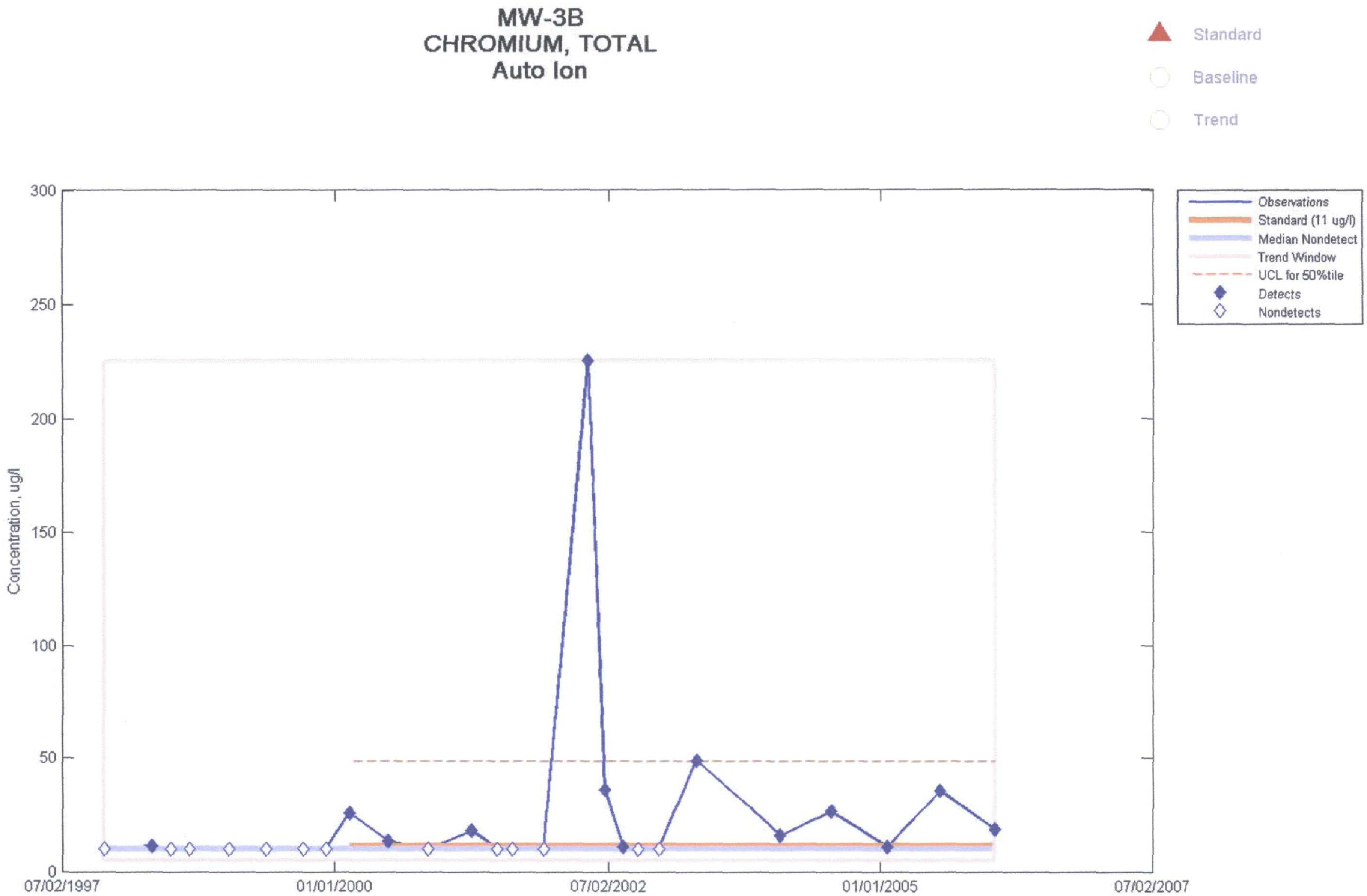
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

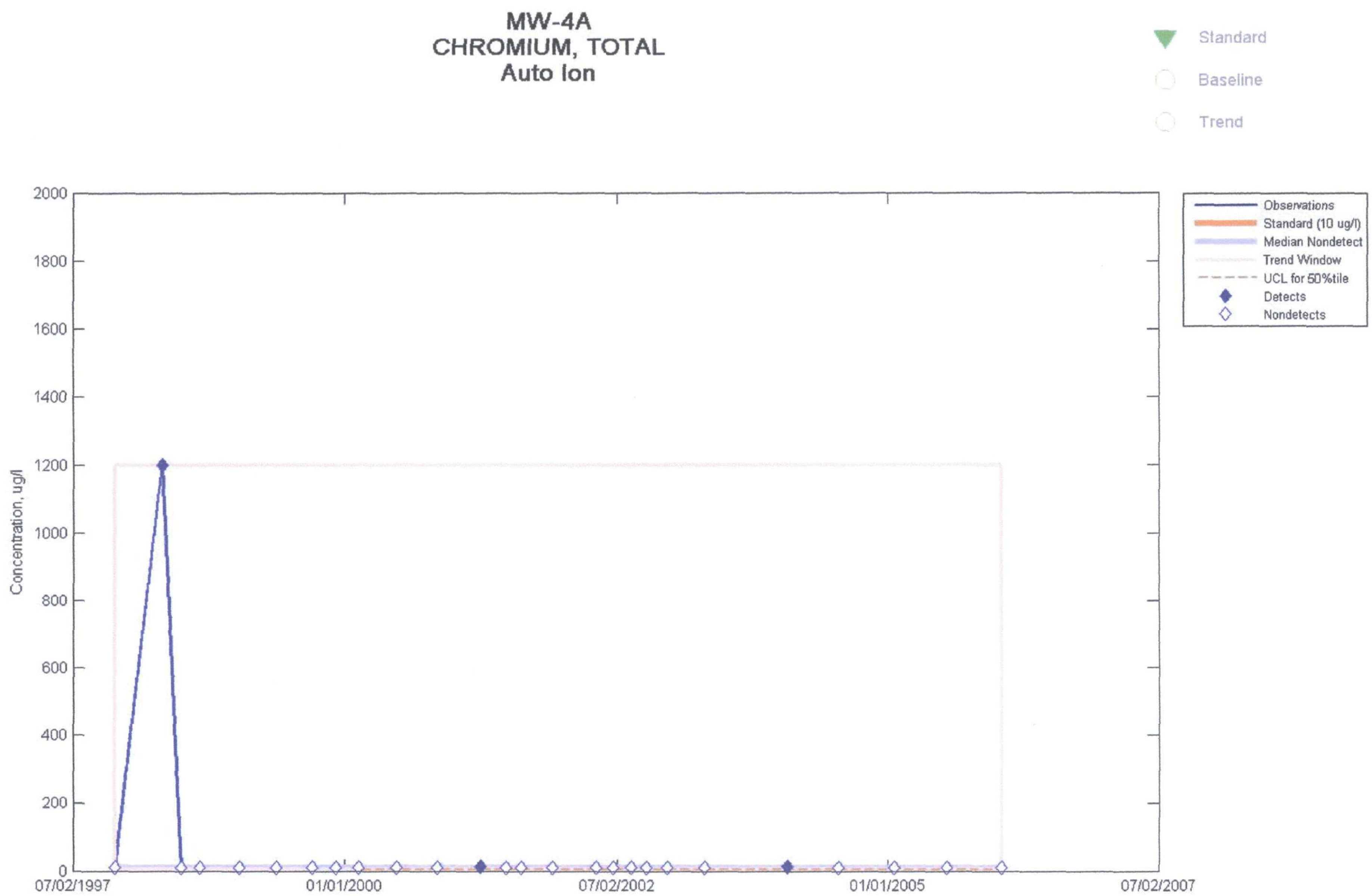
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Exceedance <UCL = 4.82e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 1.07e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

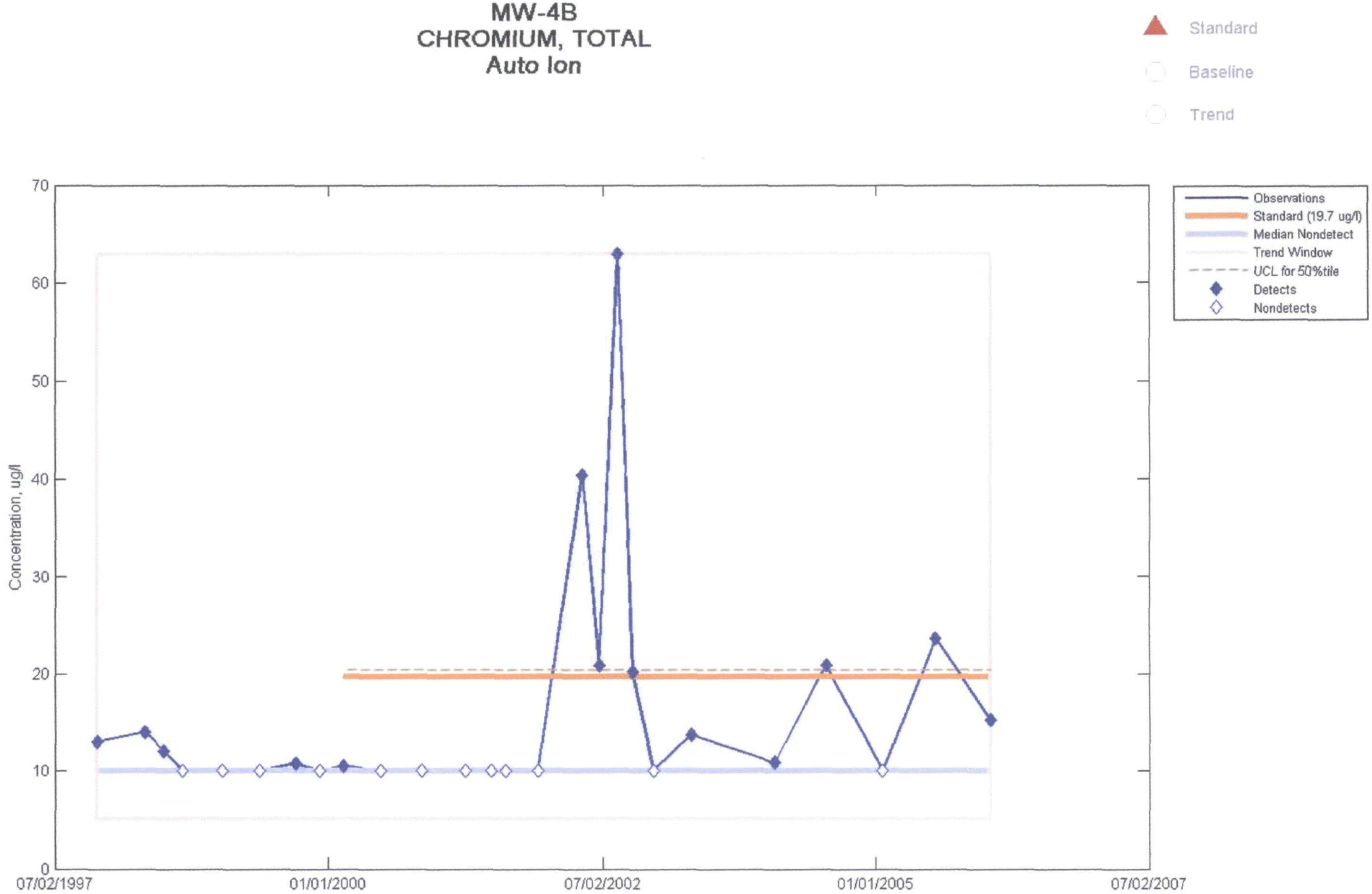


Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-4B
CHROMIUM, TOTAL
Auto Ion



Standard Test (95%): Exceedance <UCL = 2.03e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

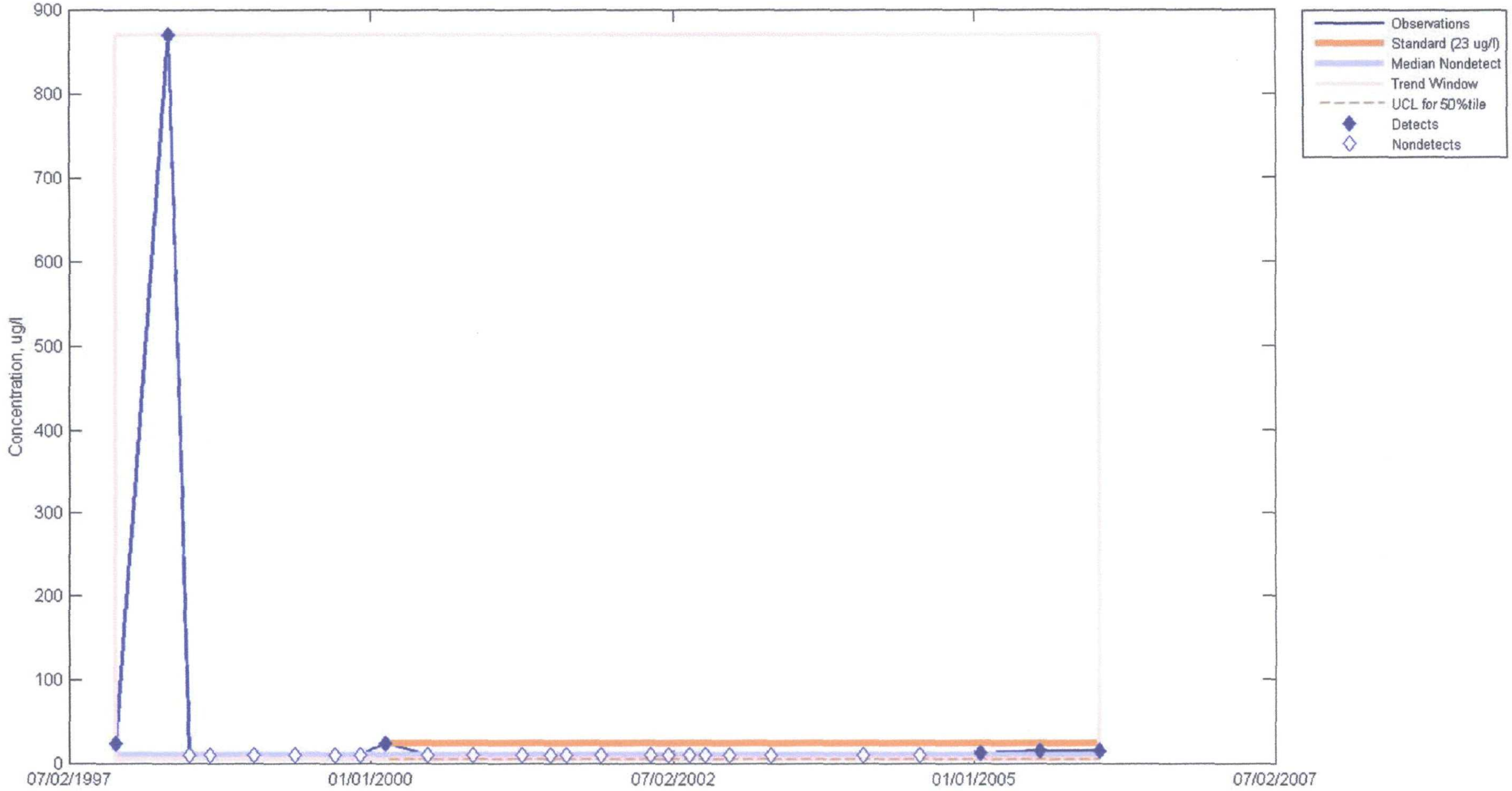
Run Date: 13-Jun-2006
Prepared by: USEPA

MW-5A
CHROMIUM, TOTAL
Auto Ion

Standard

Baseline

Trend

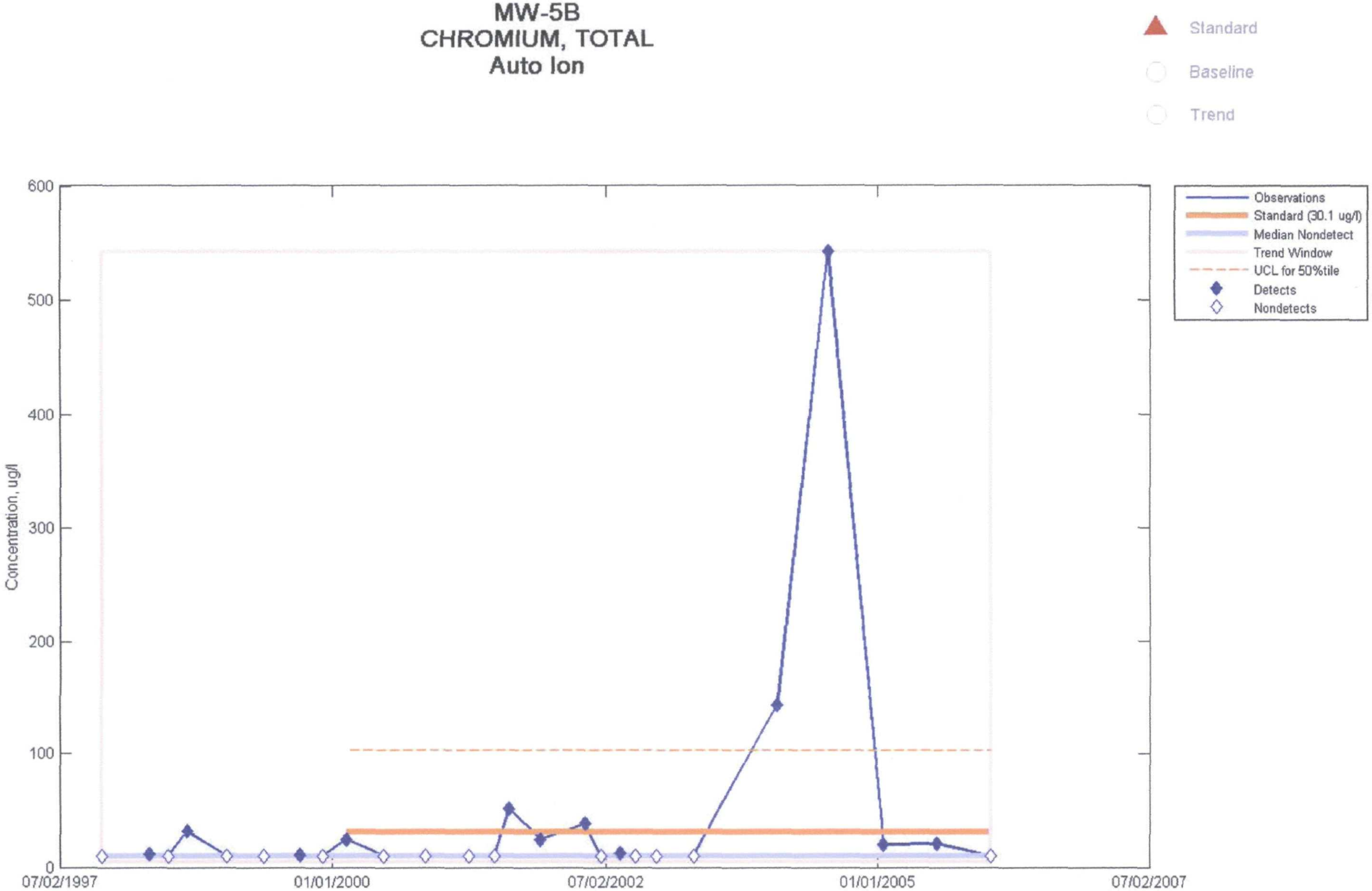


Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

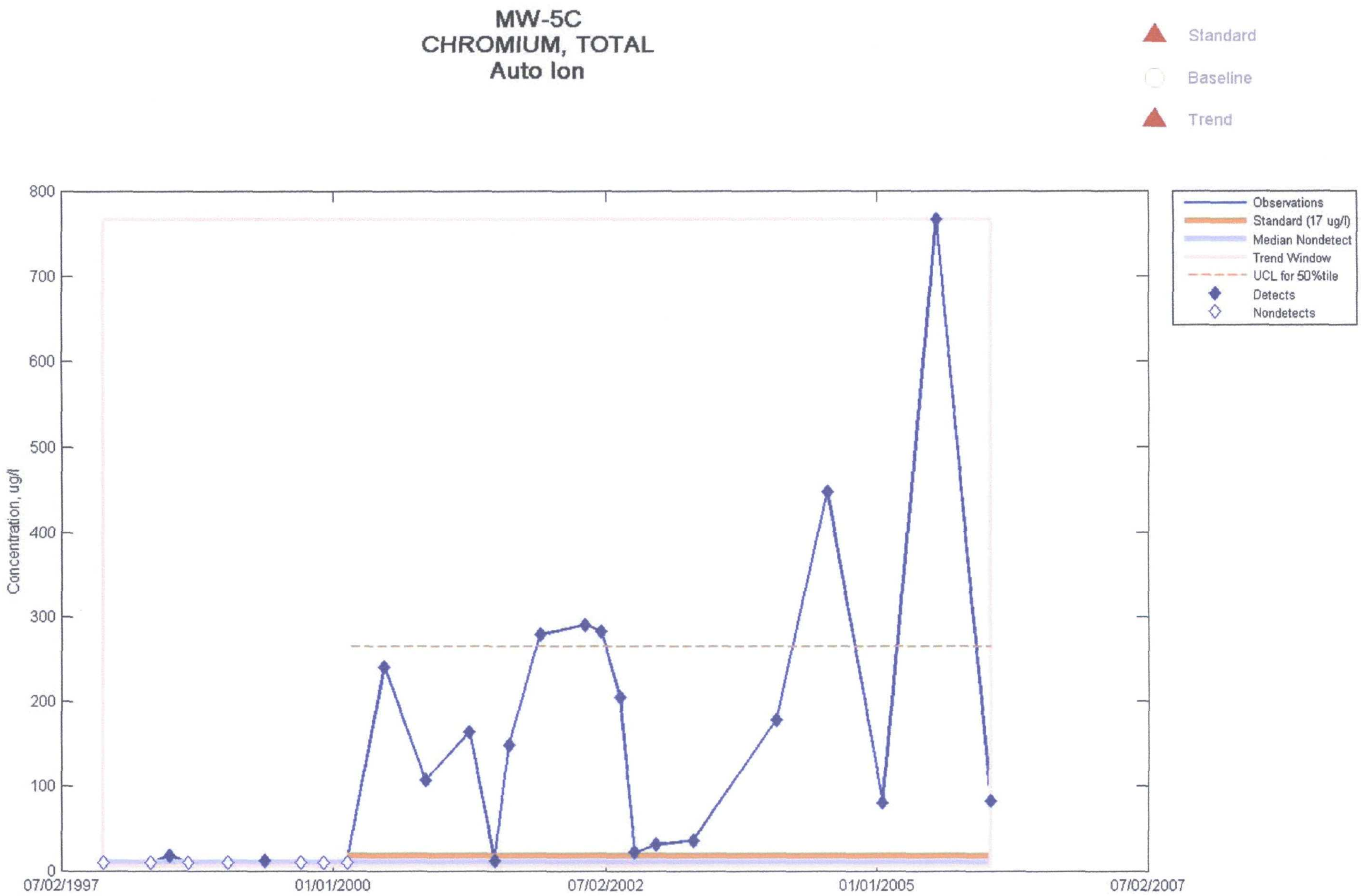
MW-5B
CHROMIUM, TOTAL
Auto Ion



Standard Test (95%): Exceedance <UCL = 1.02e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

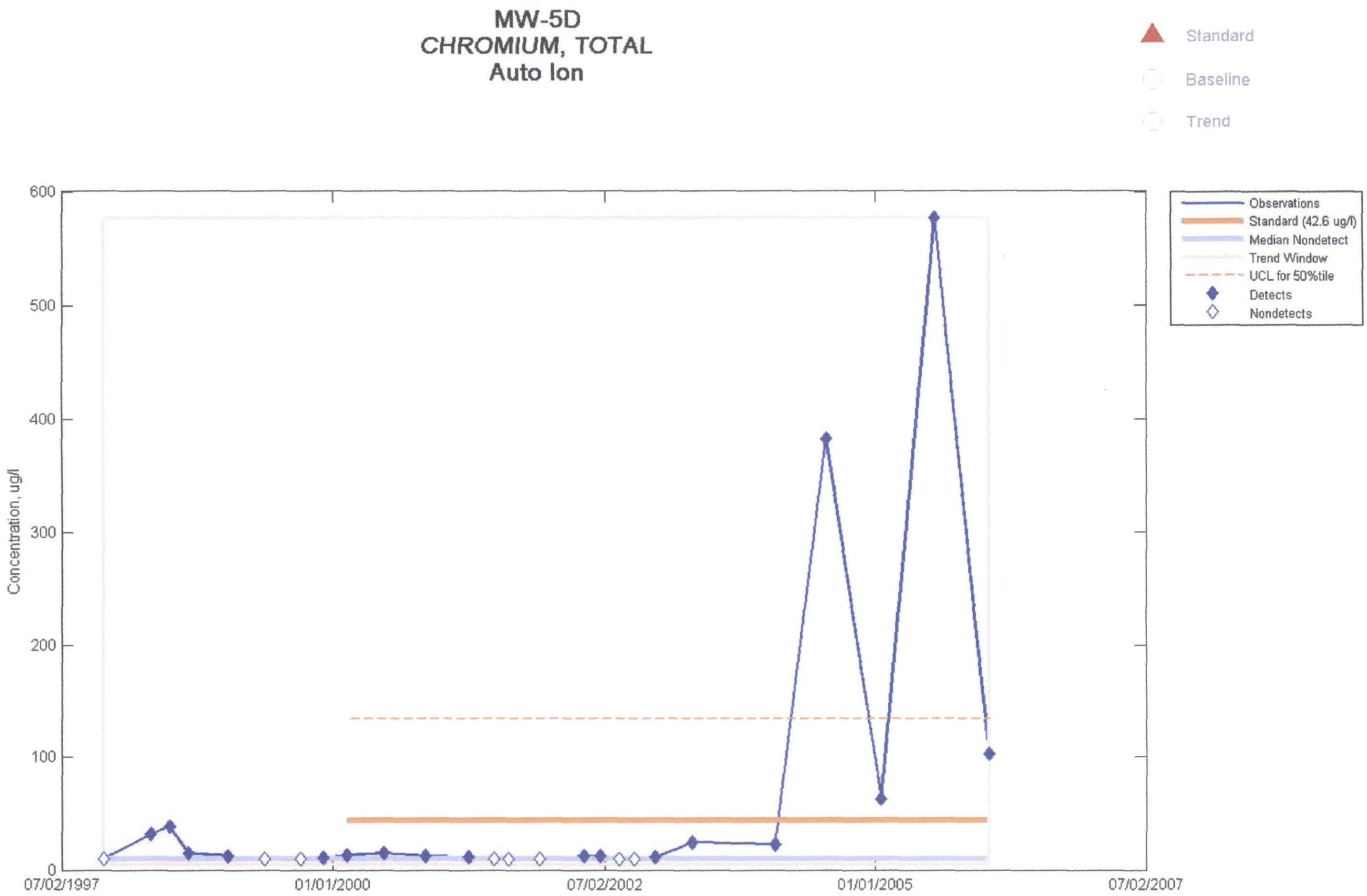
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Exceedance <UCL = 2.64e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Upward <Slope = 1.97e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

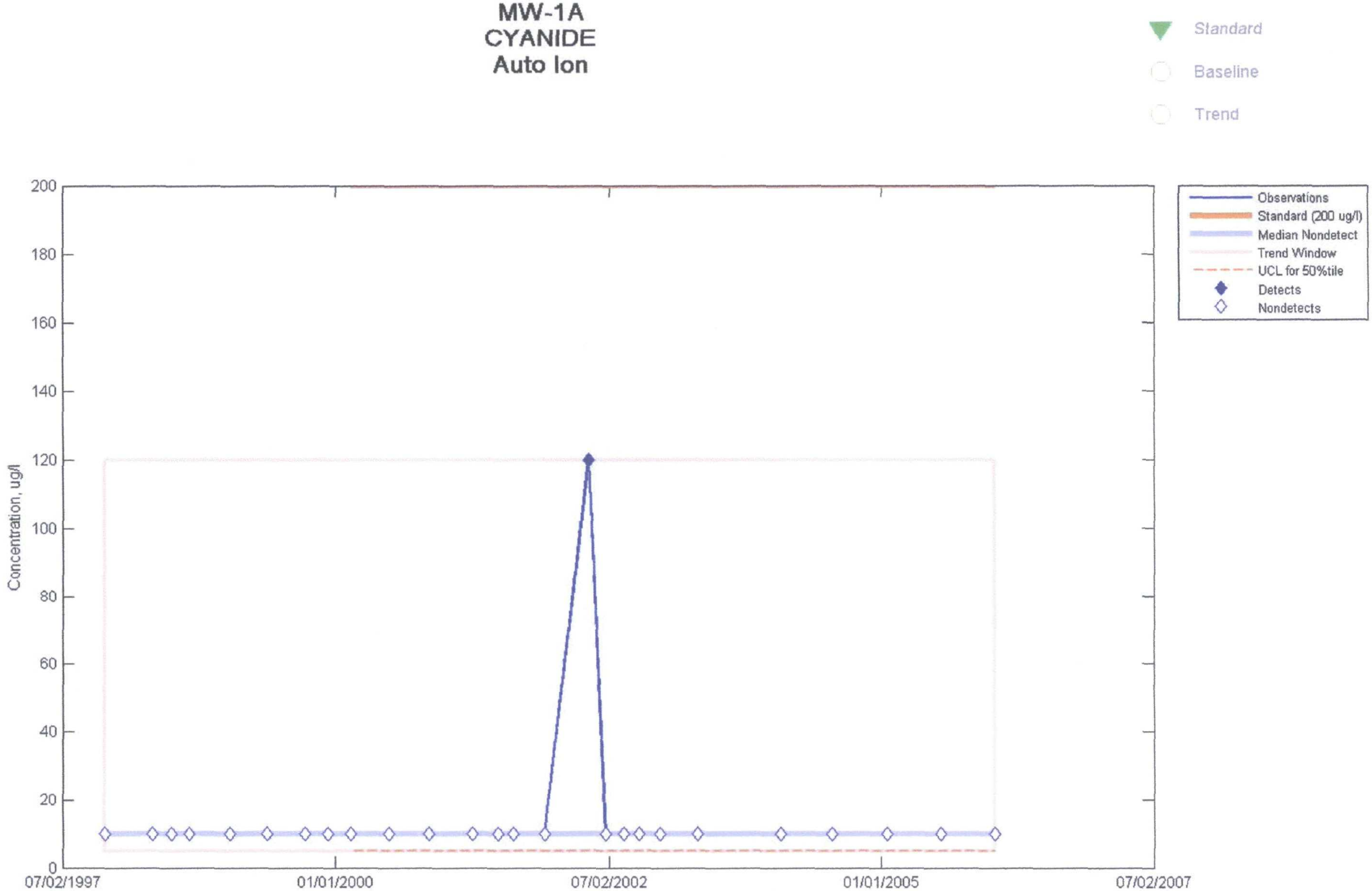


Standard Test (95%): Exceedance <UCL = 1.34e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 2.02e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

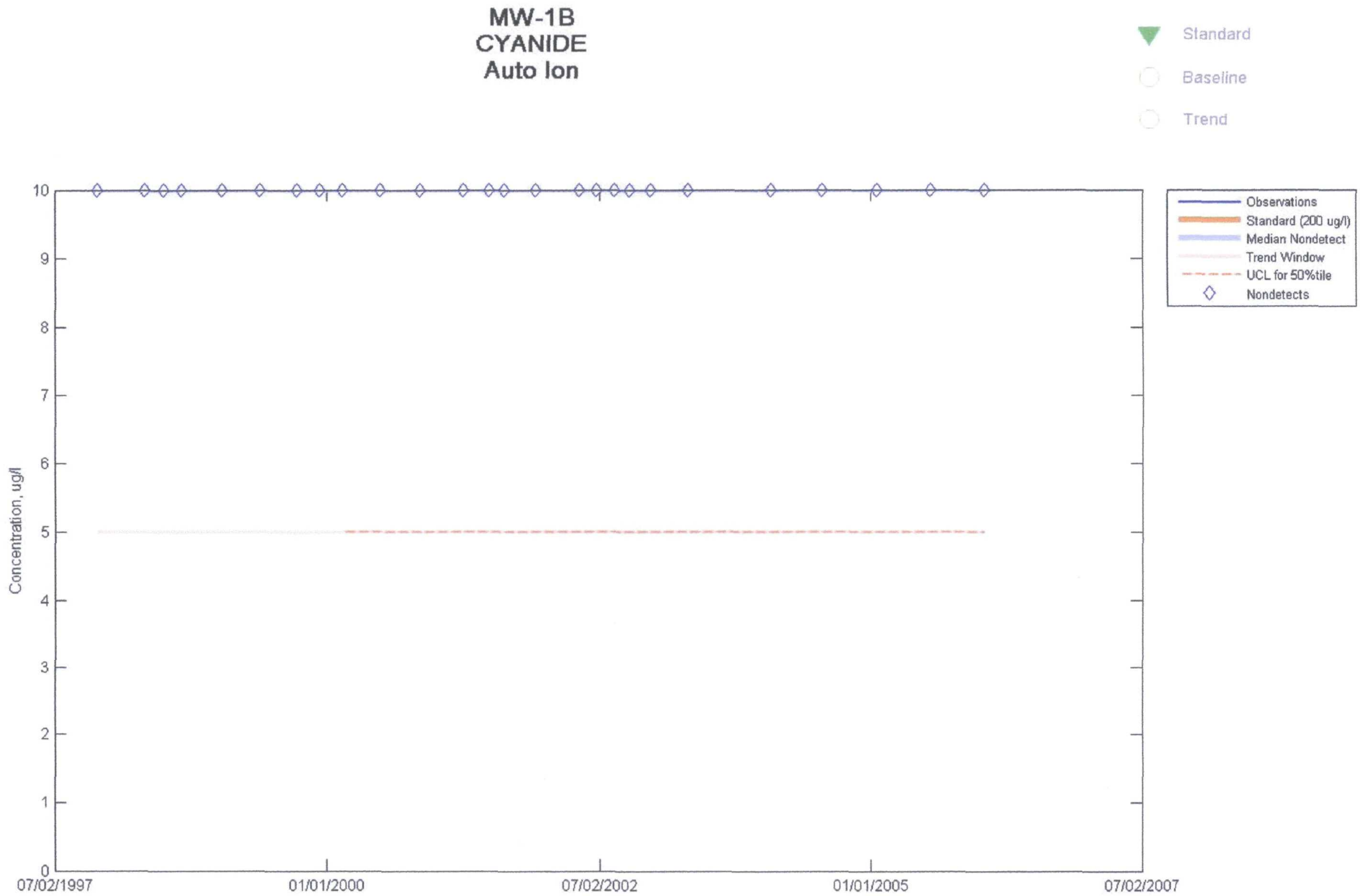
MW-1A
CYANIDE
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

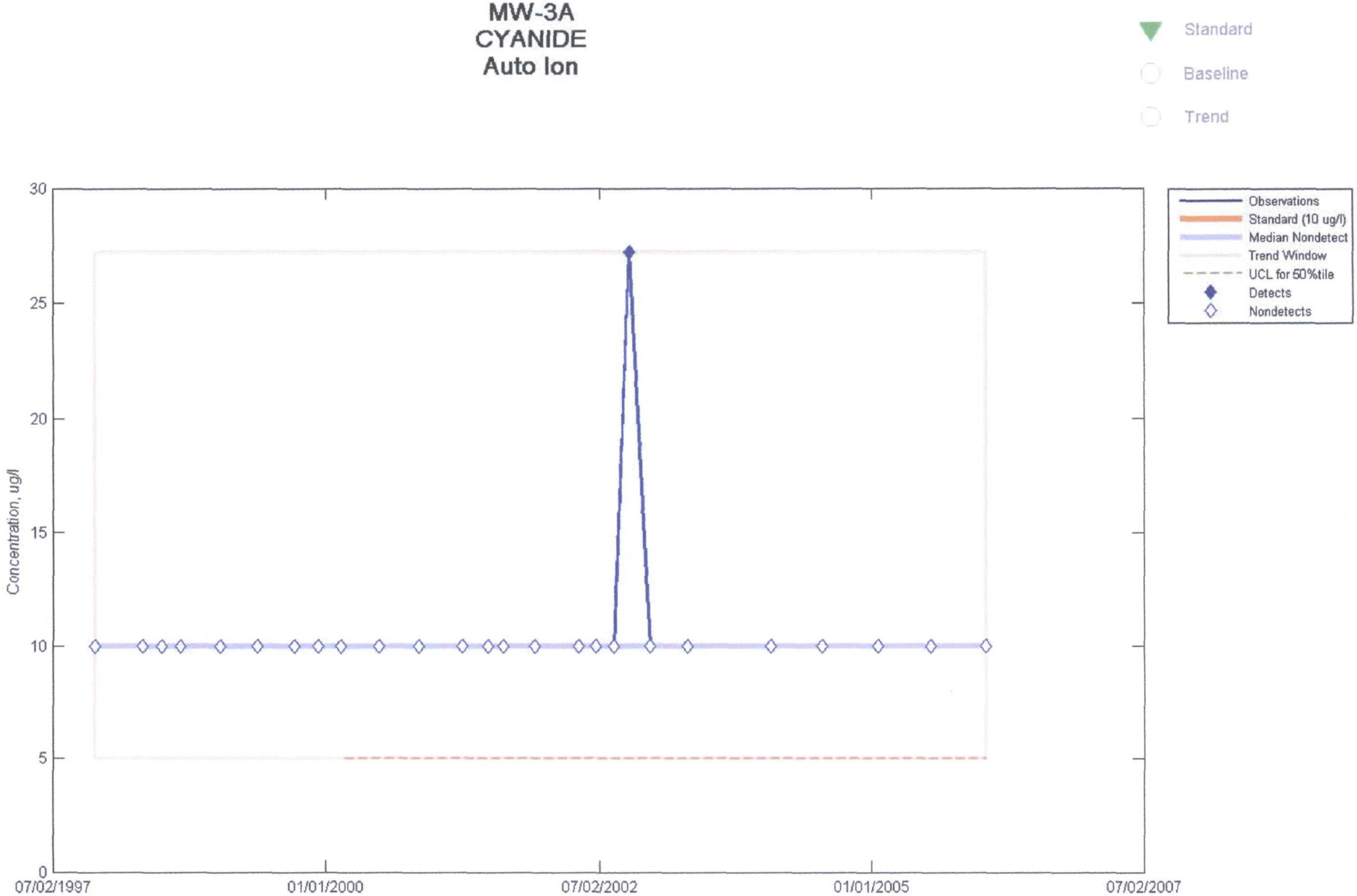


Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-3A
CYANIDE
Auto Ion

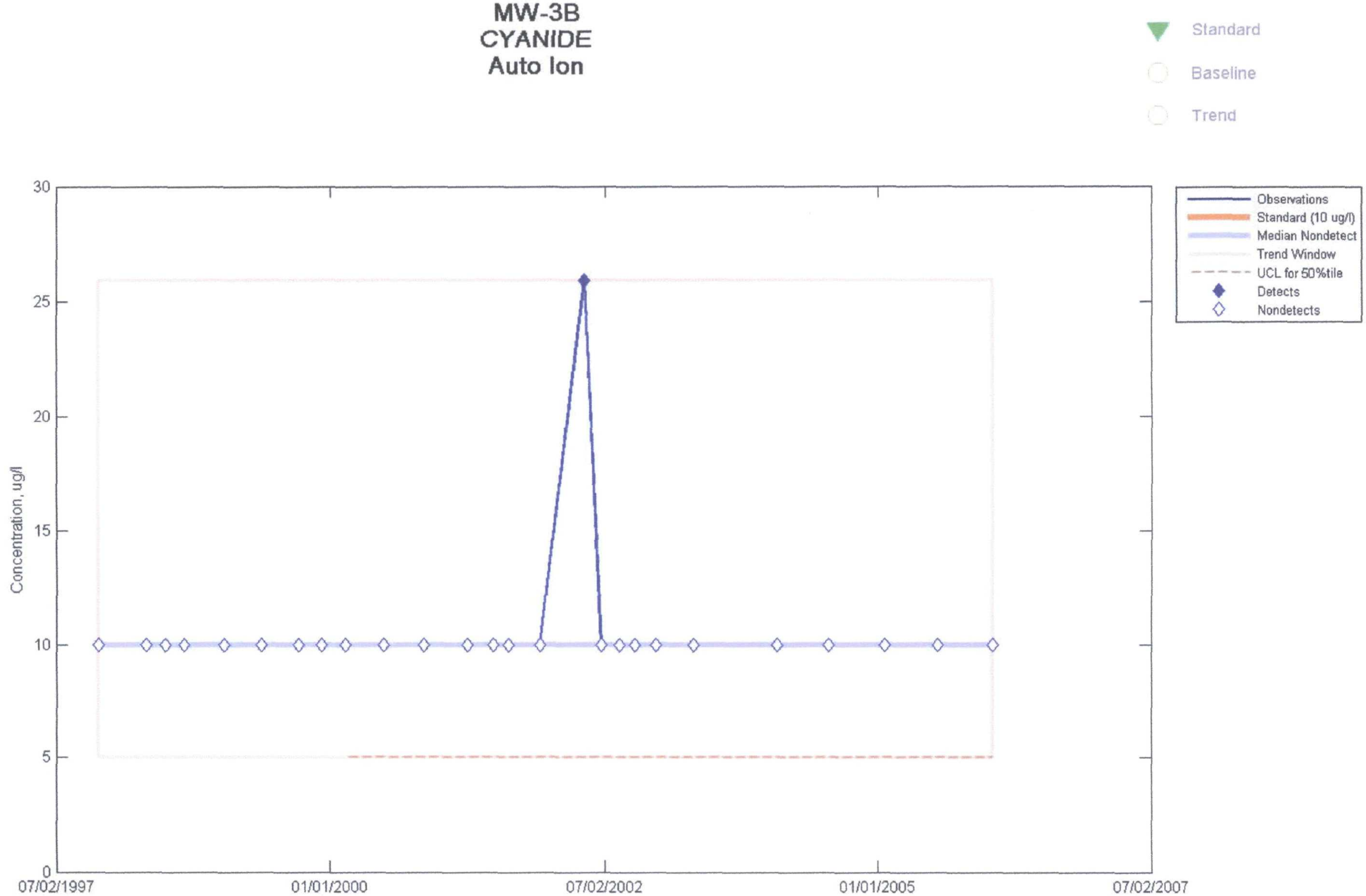


Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

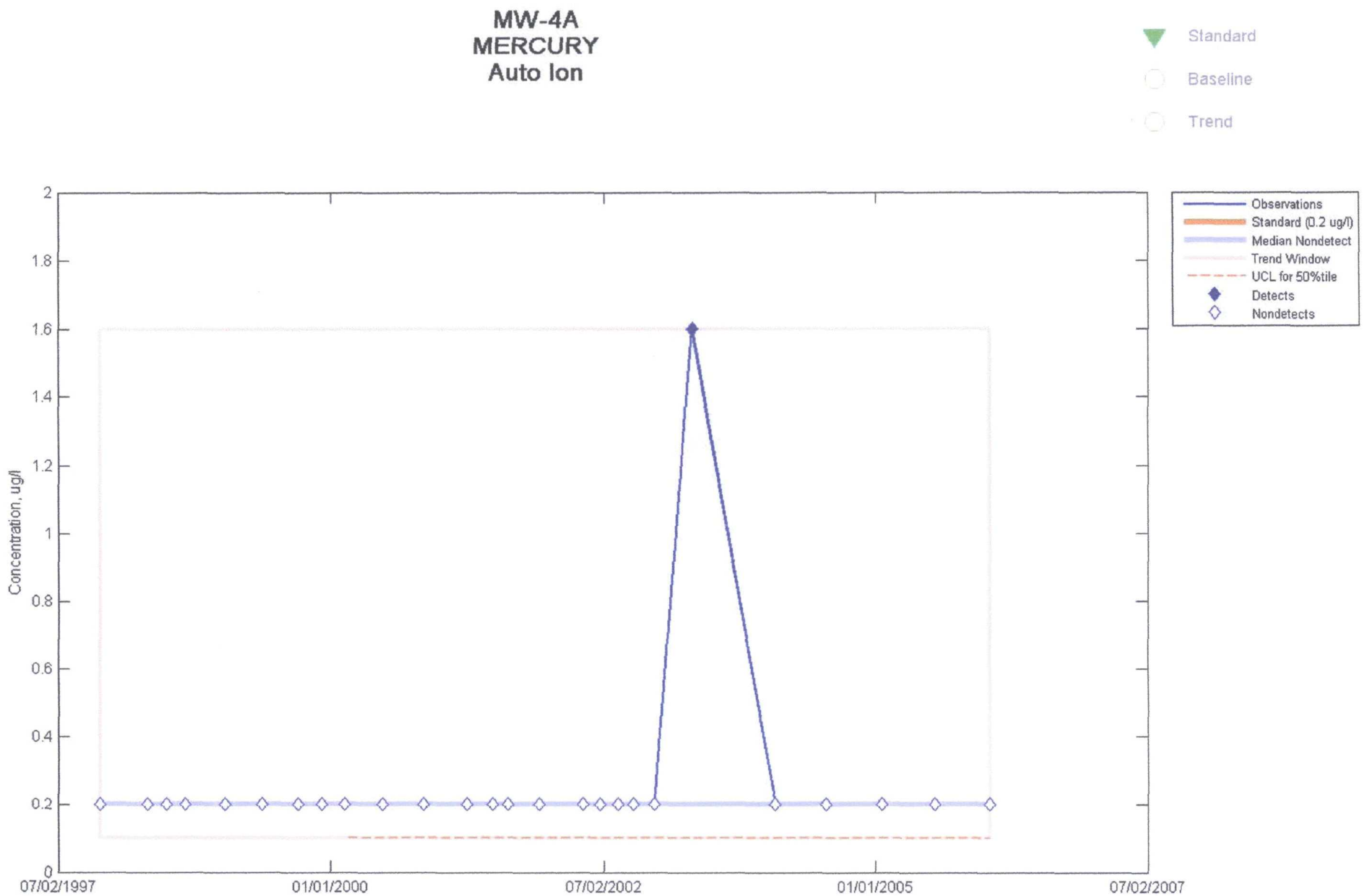
MW-3B
CYANIDE
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

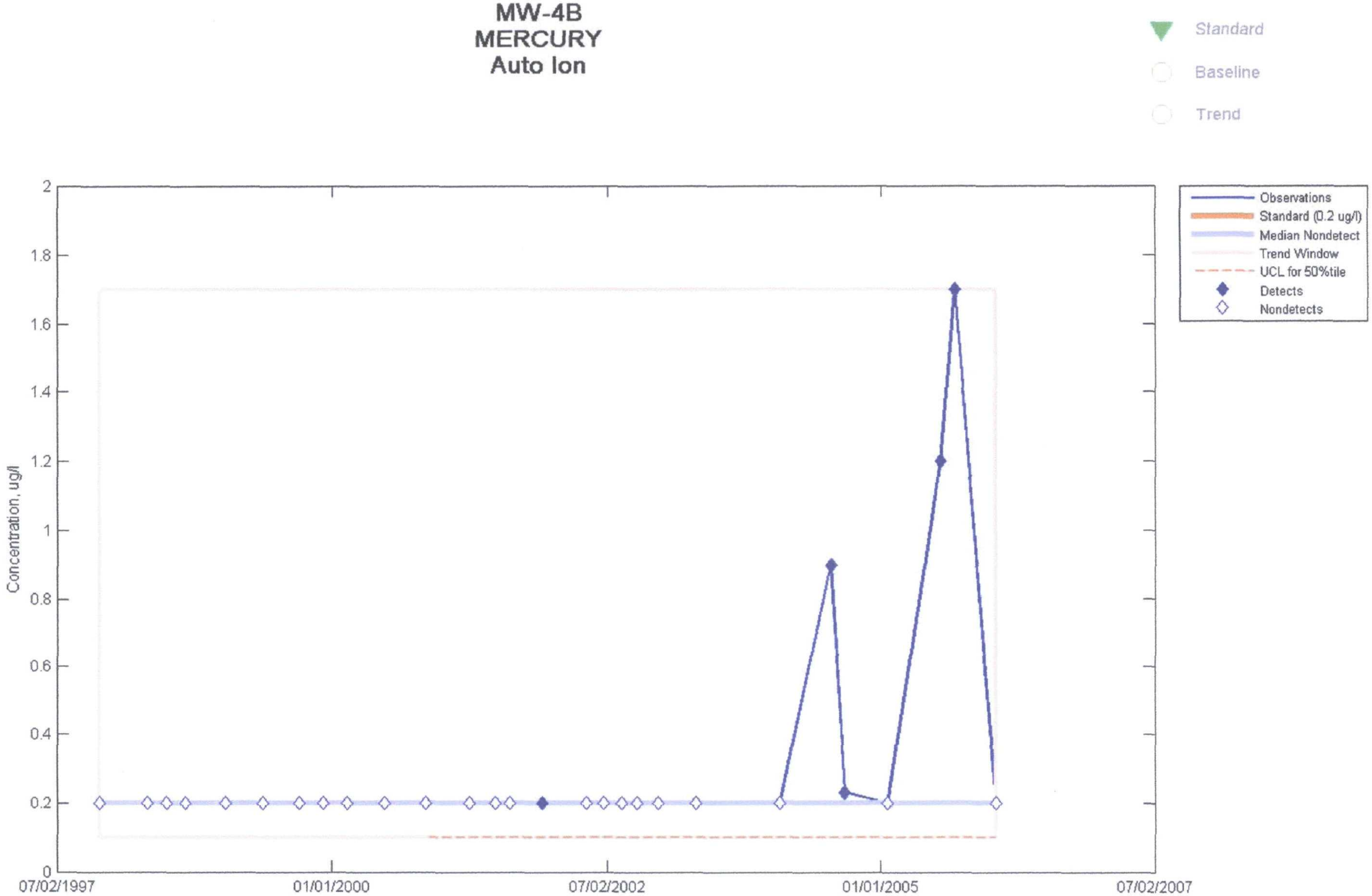


Standard Test (95%): Compliance <UCL = 1.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-4B
MERCURY
Auto Ion

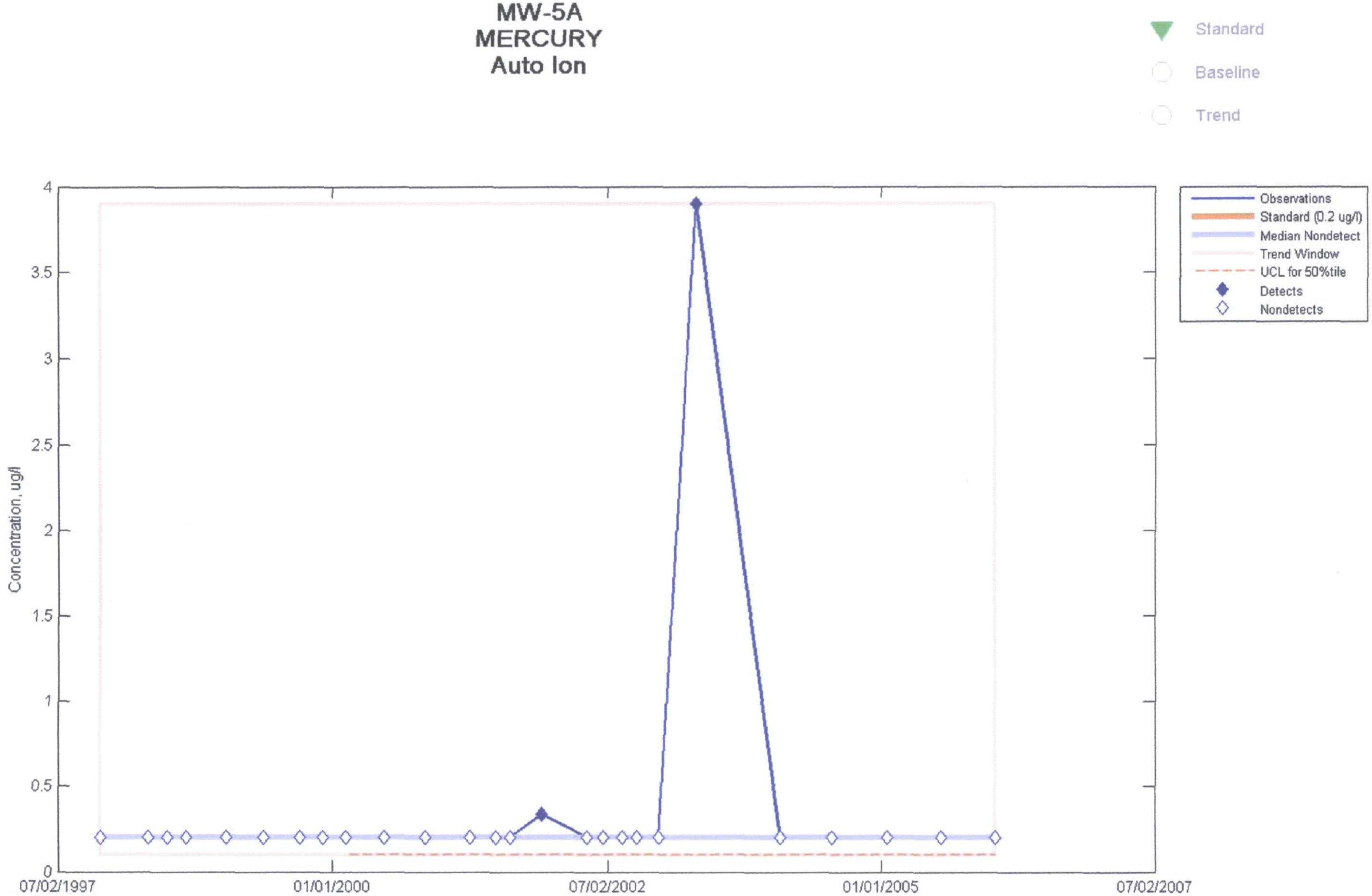


Standard Test (95%): Compliance <UCL = 1.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

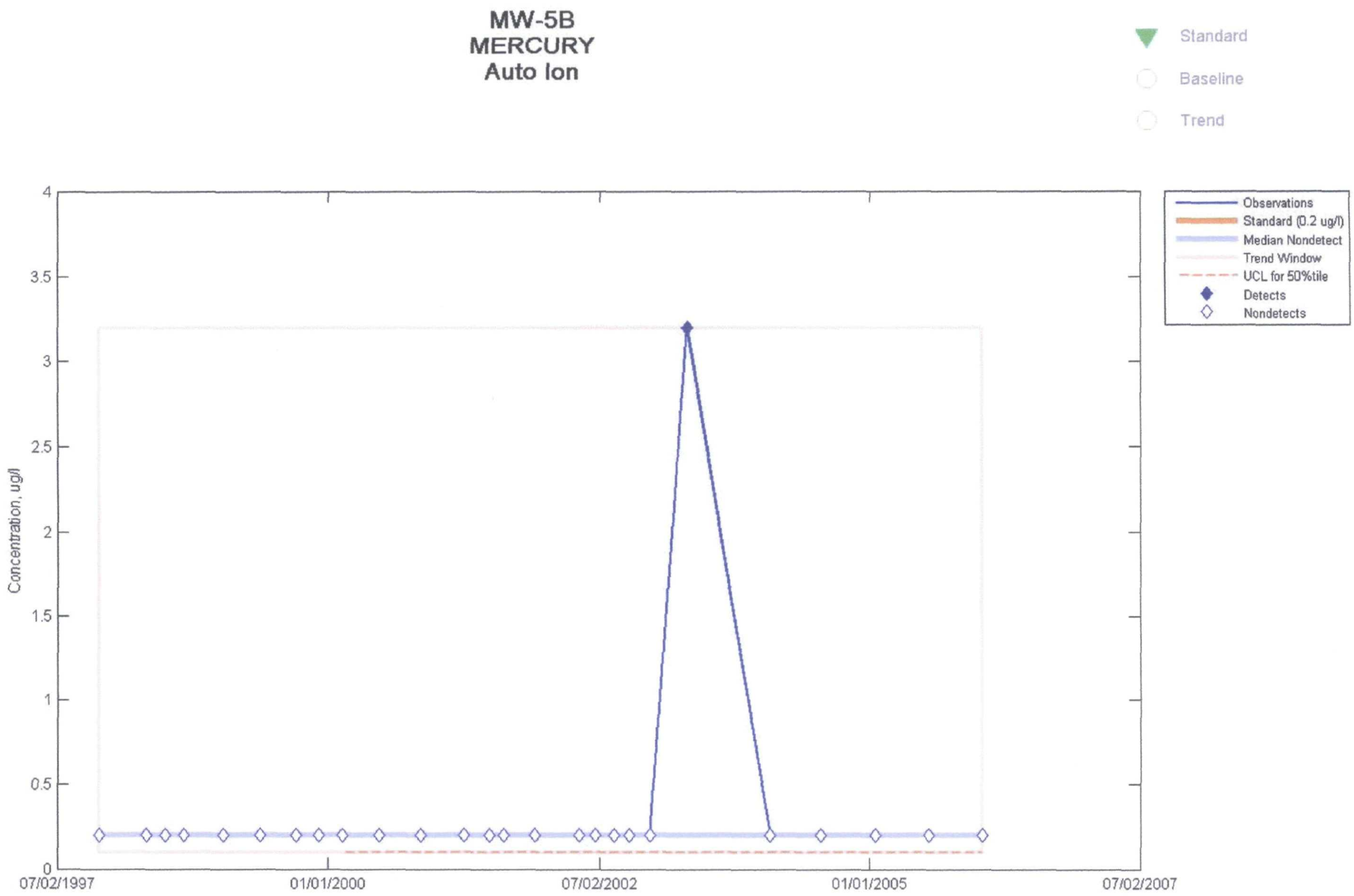
MW-5A
MERCURY
Auto Ion



Standard Test (95%): Compliance <UCL = 1.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

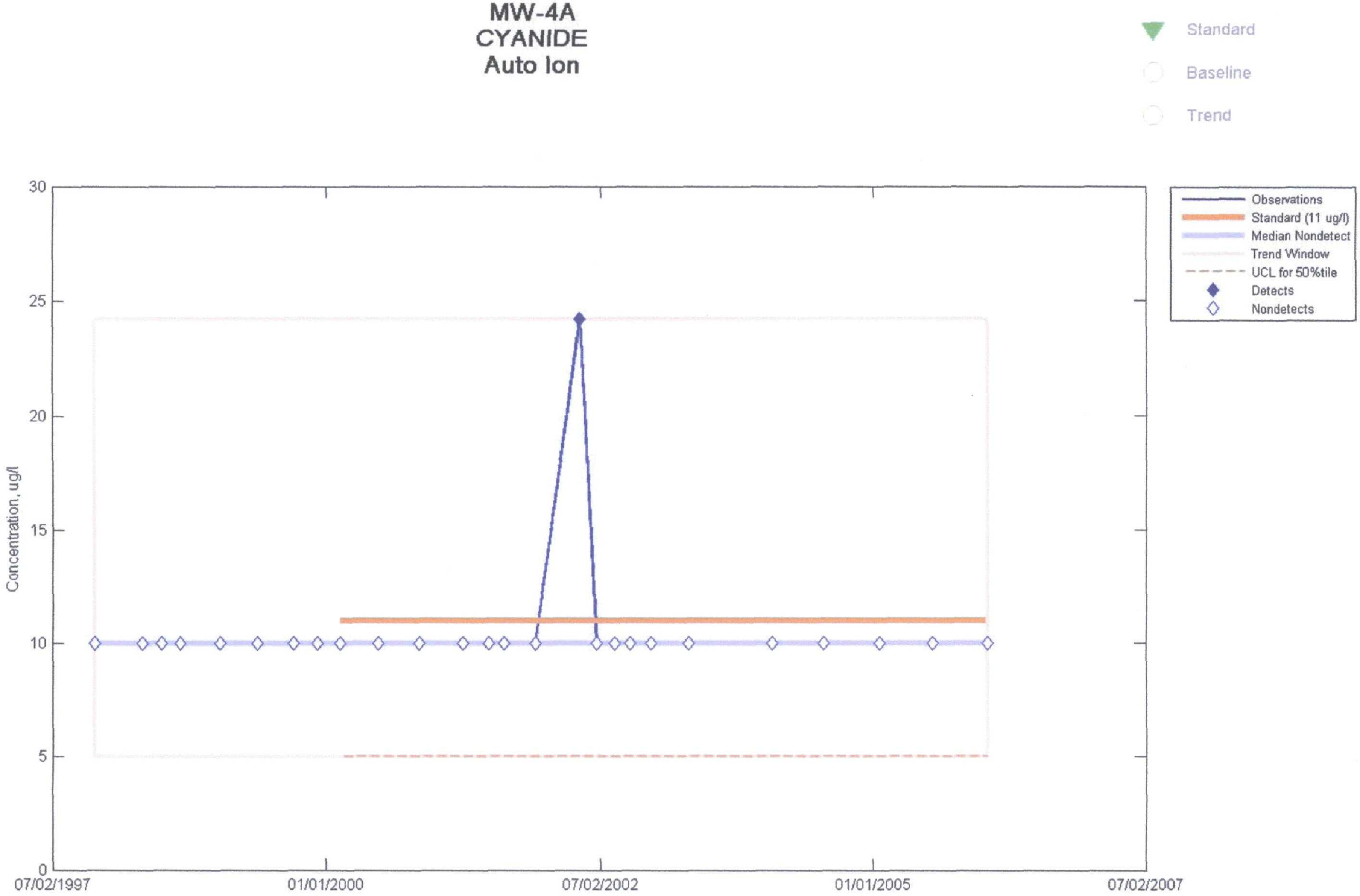


Standard Test (95%): Compliance <UCL = 1.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

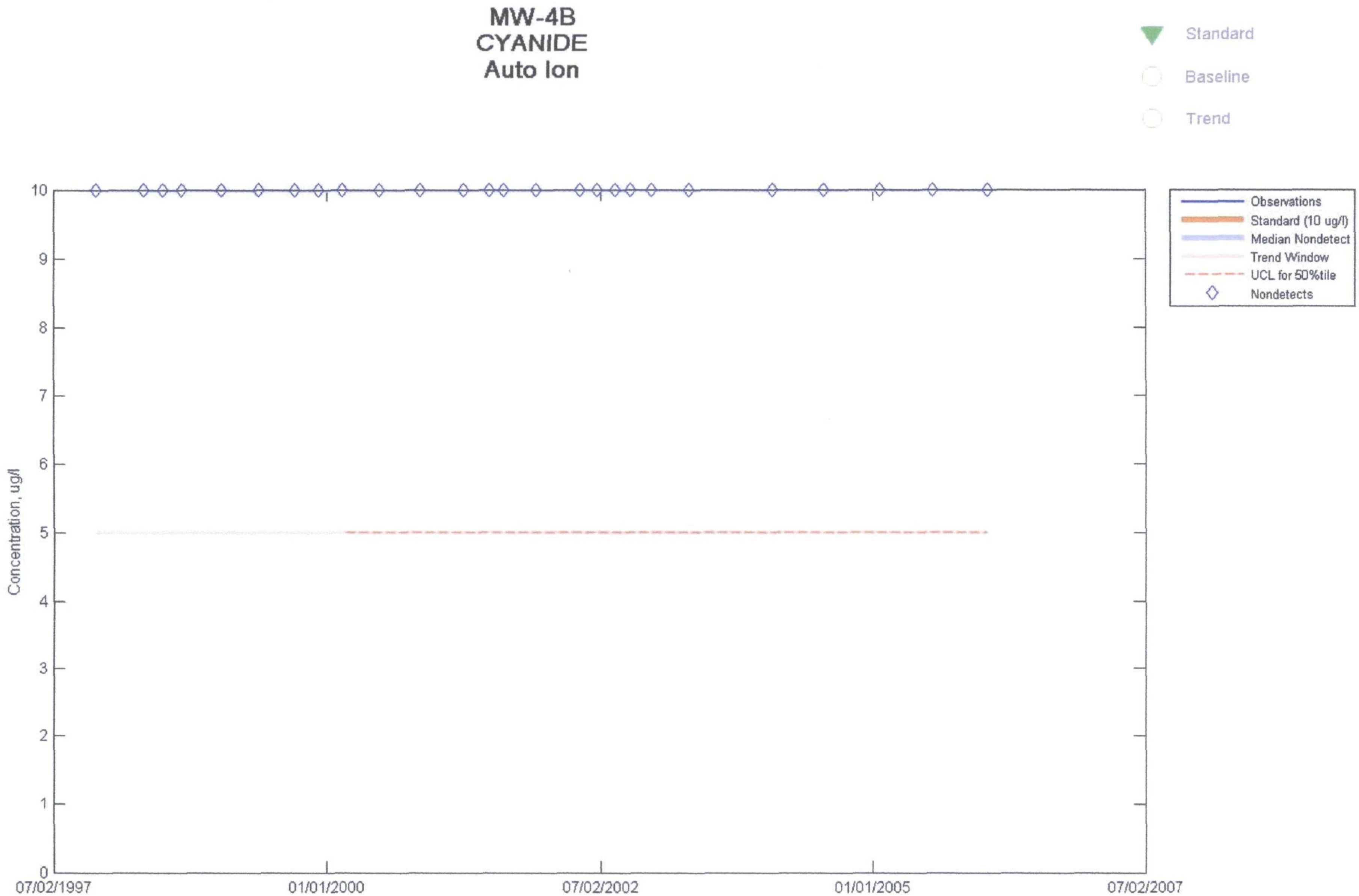
MW-4A
CYANIDE
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

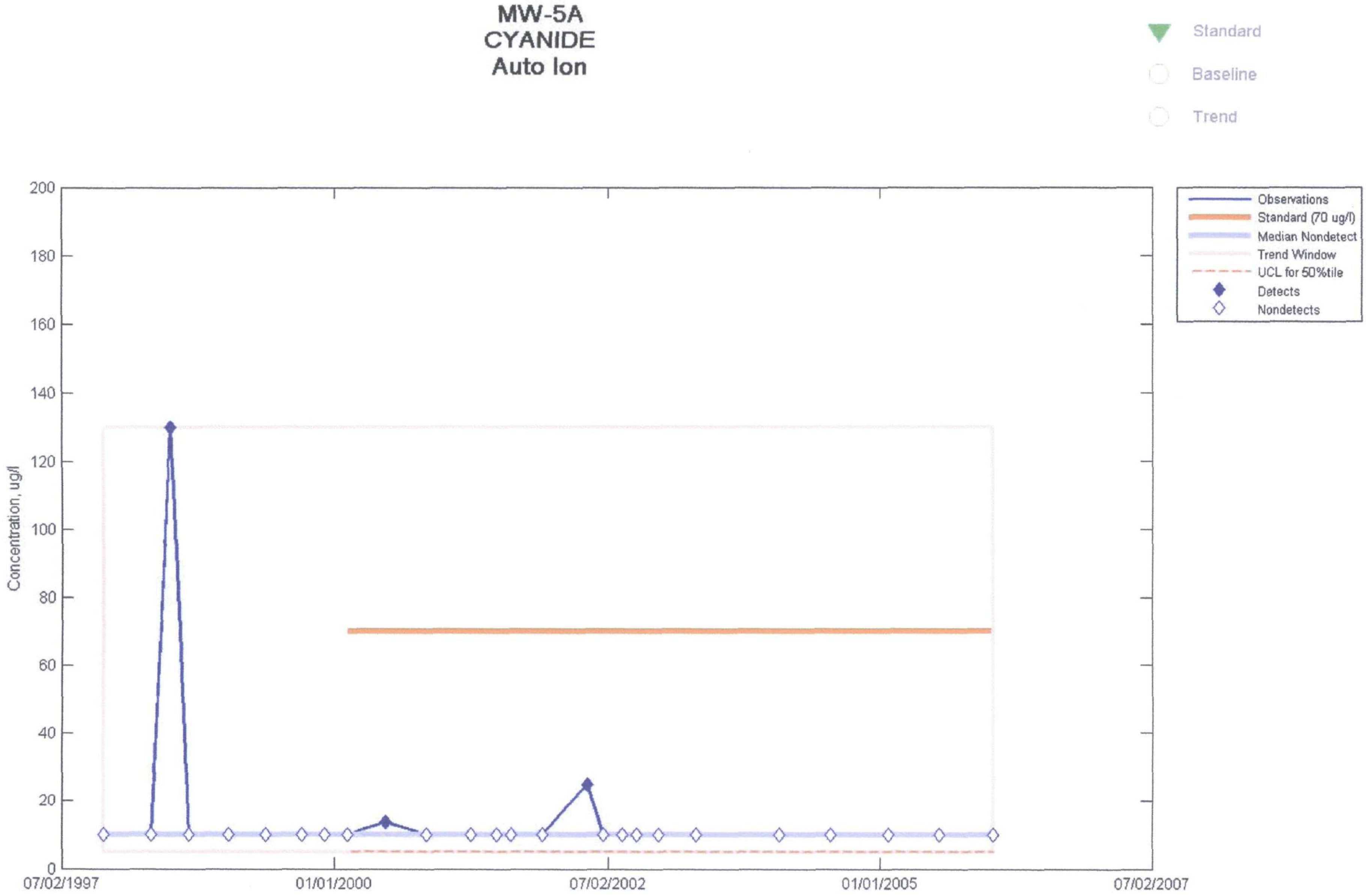
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

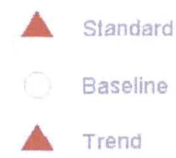


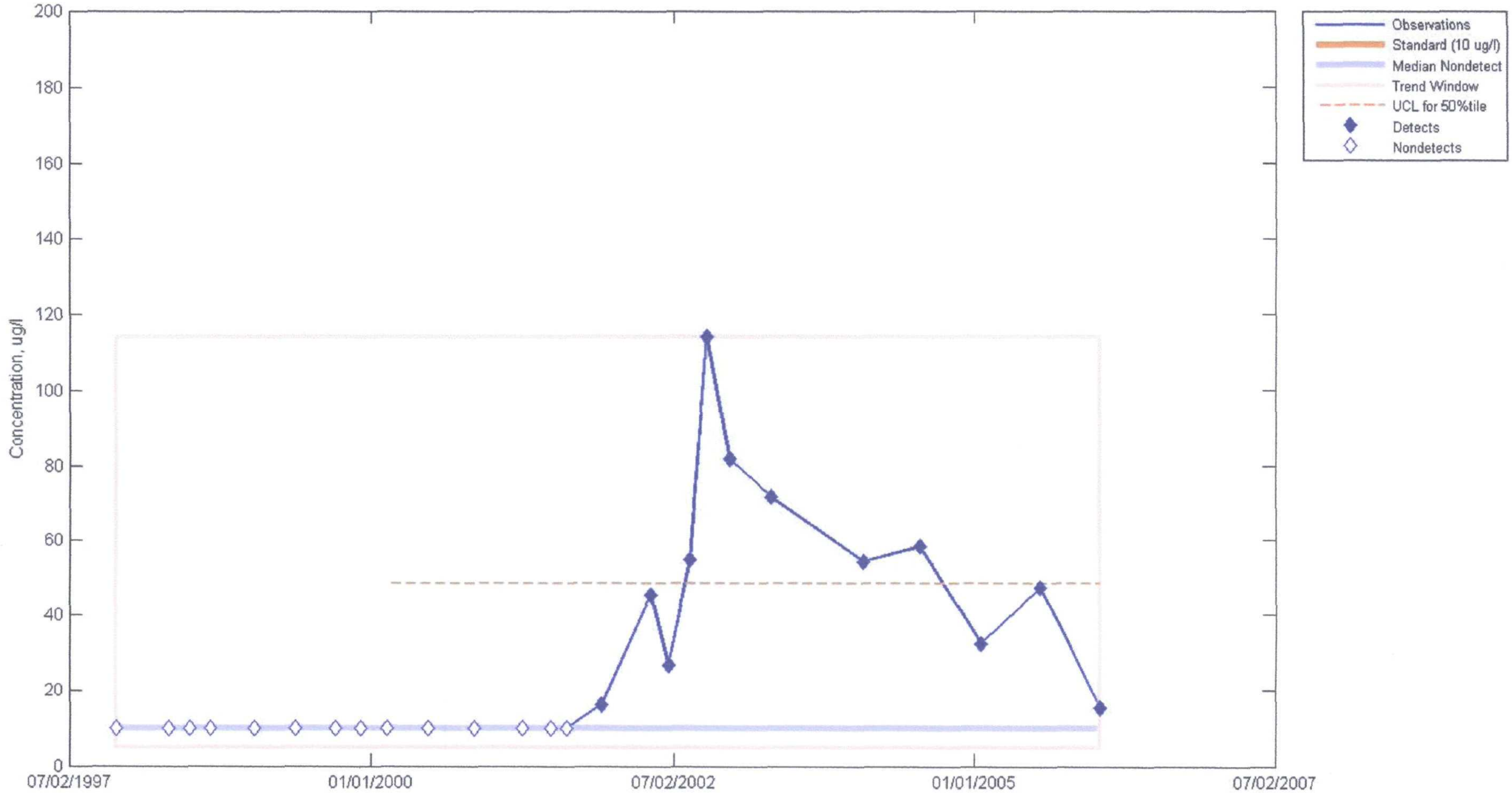
Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-5B
CYANIDE
Auto Ion



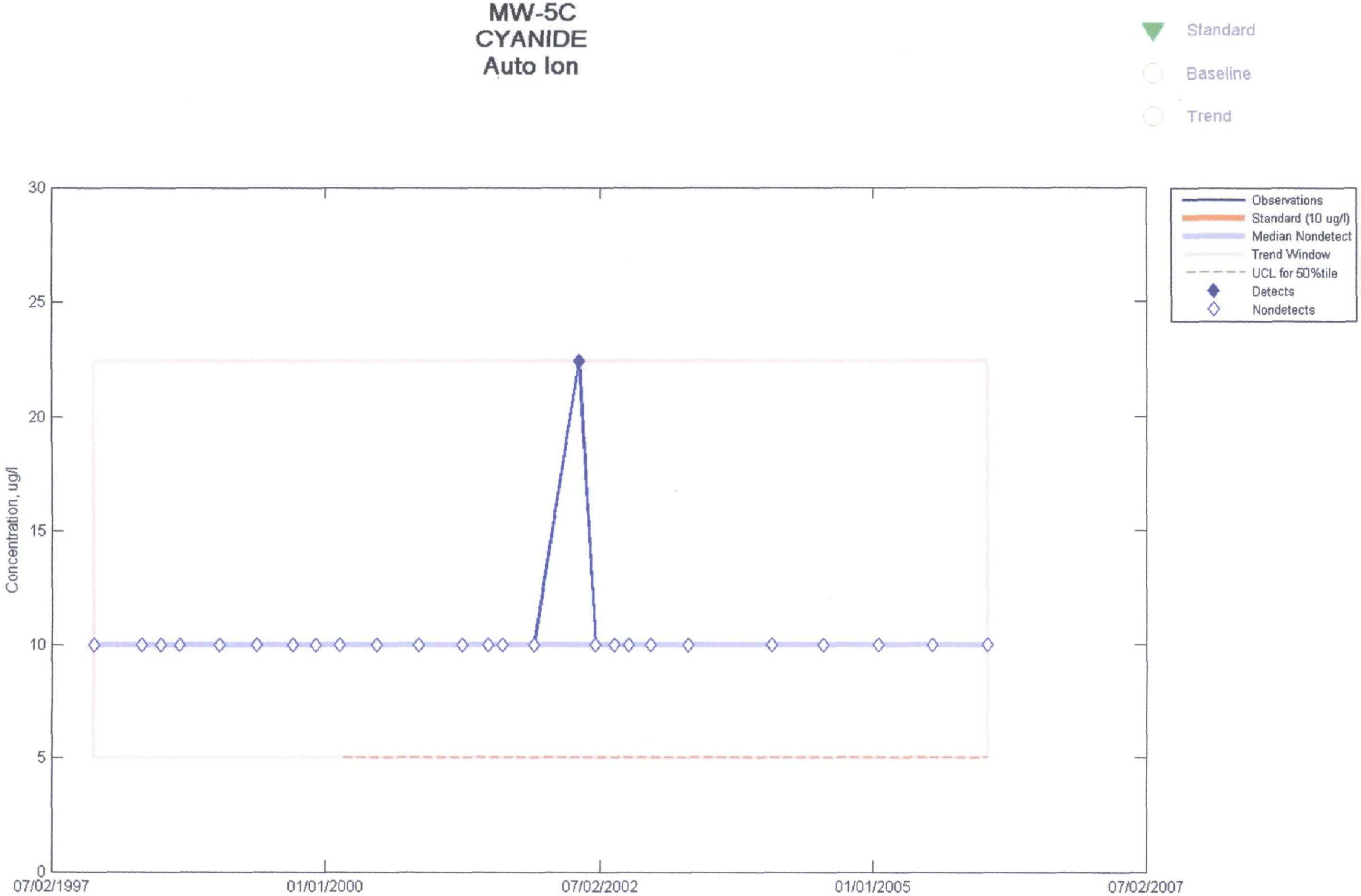


Standard Test (95%): Exceedance <UCL = 4.82e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Upward <Slope = 5.42e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

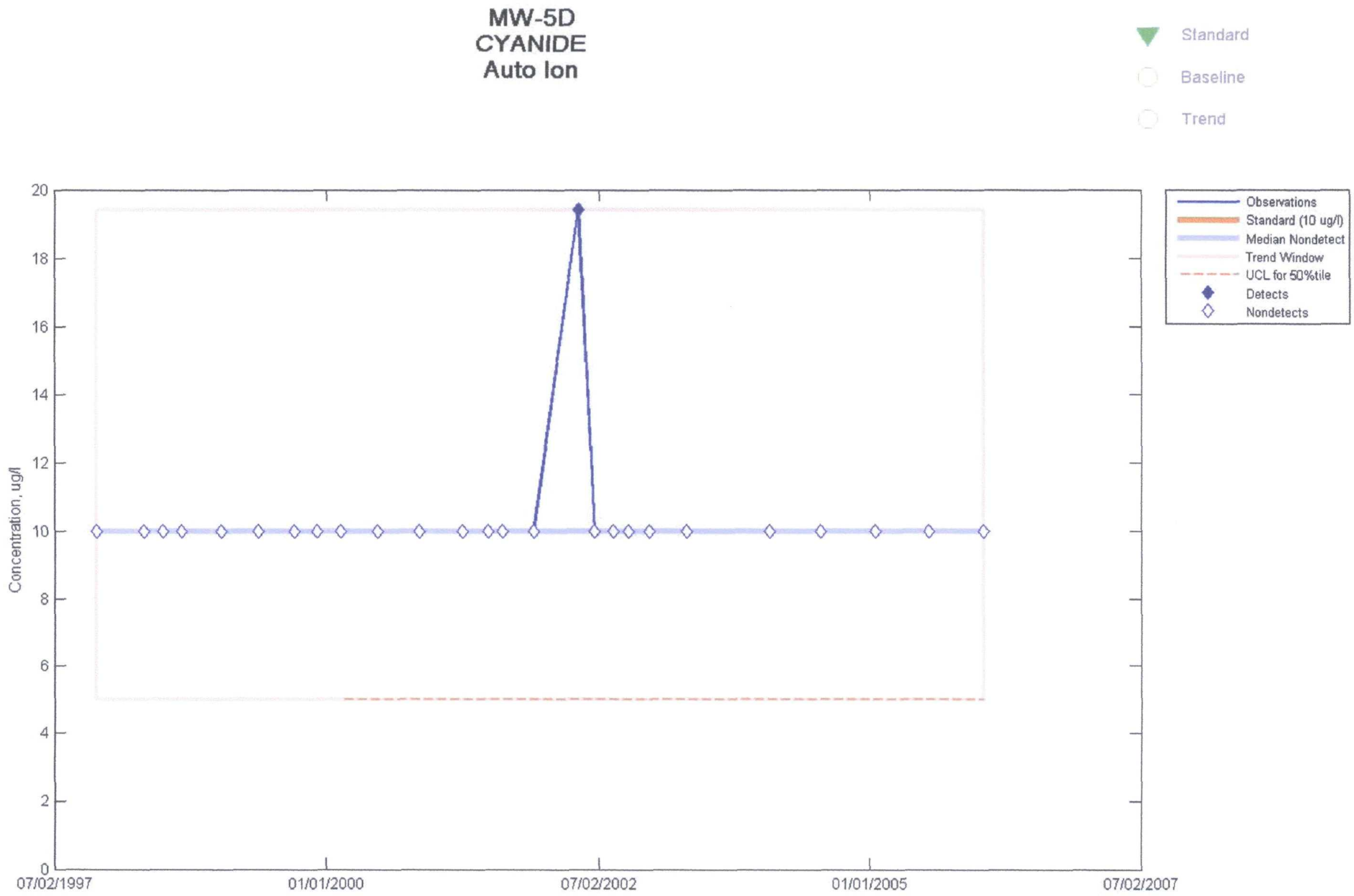
MW-5C
CYANIDE
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

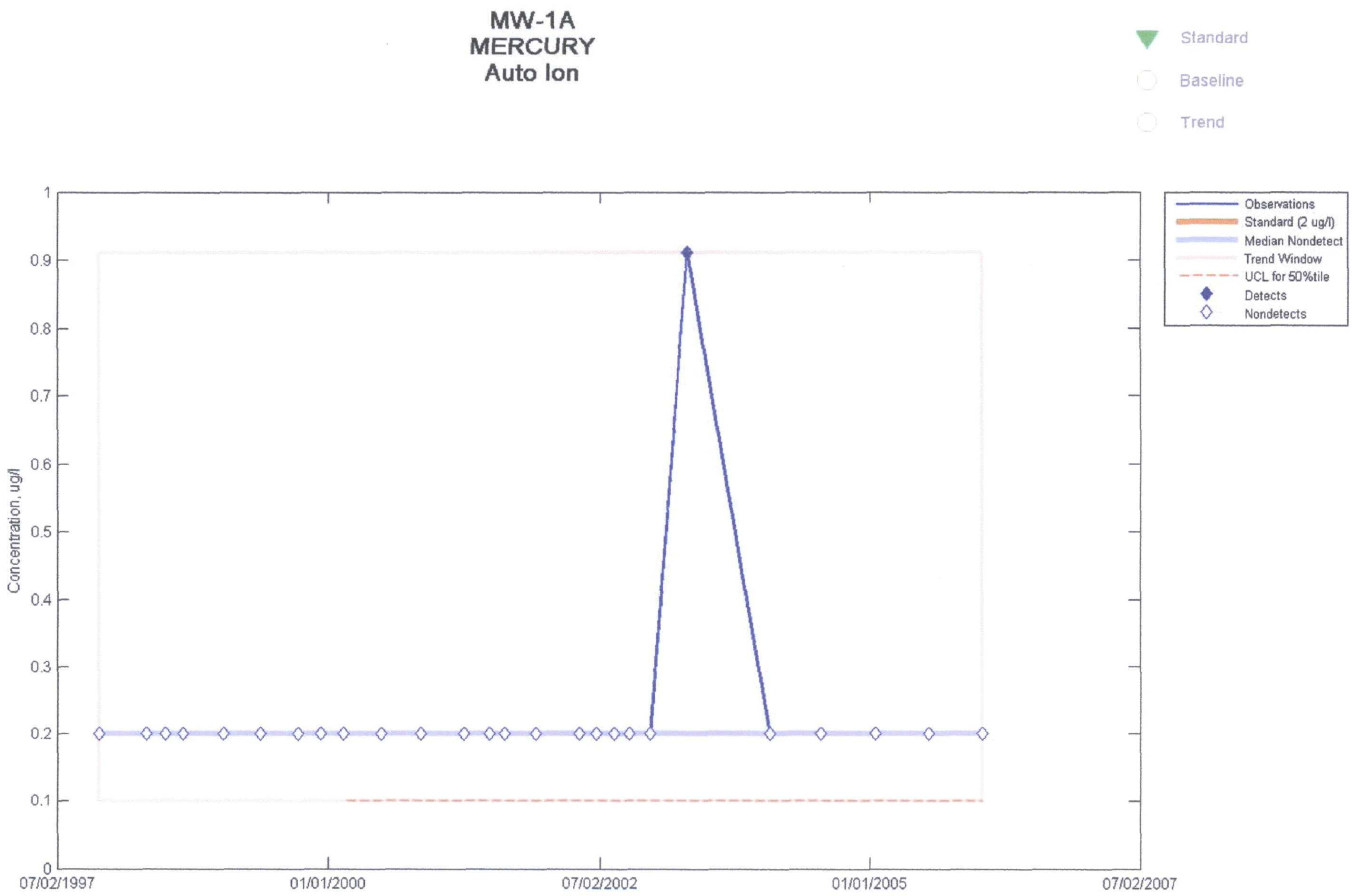
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 5.00e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

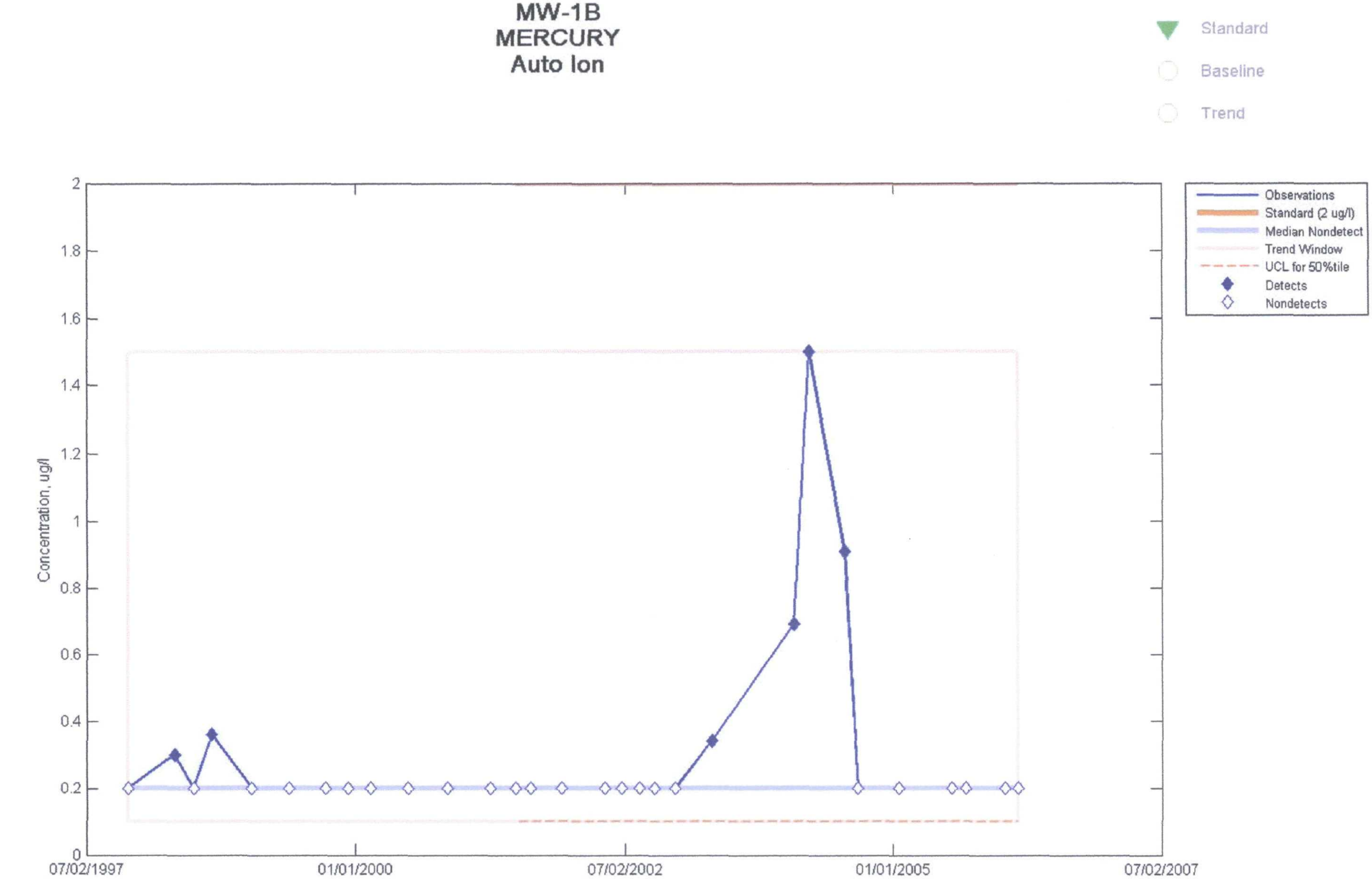


Standard Test (95%): Compliance <UCL = 1.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-1B
MERCURY
Auto Ion

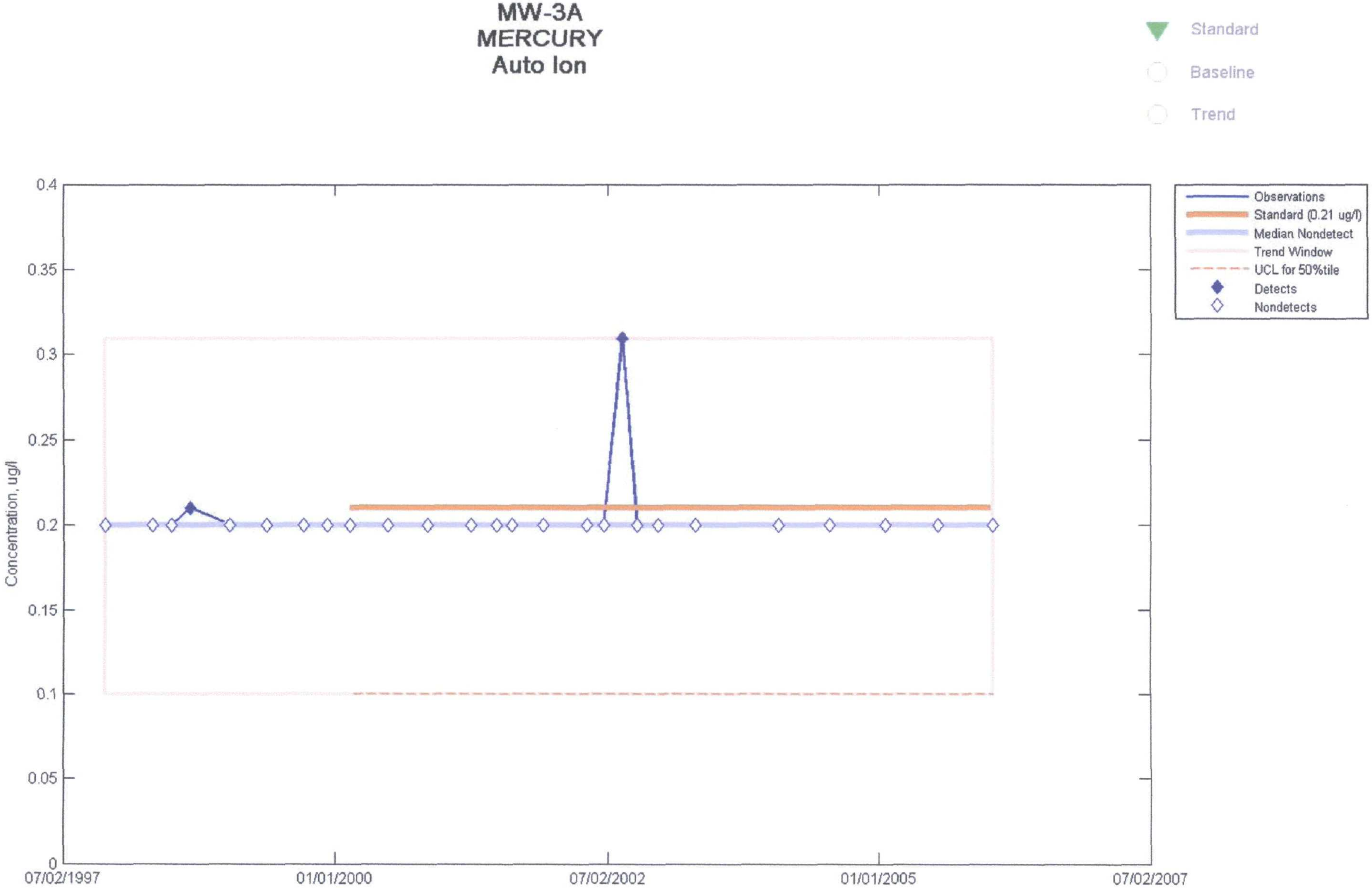


Standard Test (95%): Compliance <UCL = 1.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

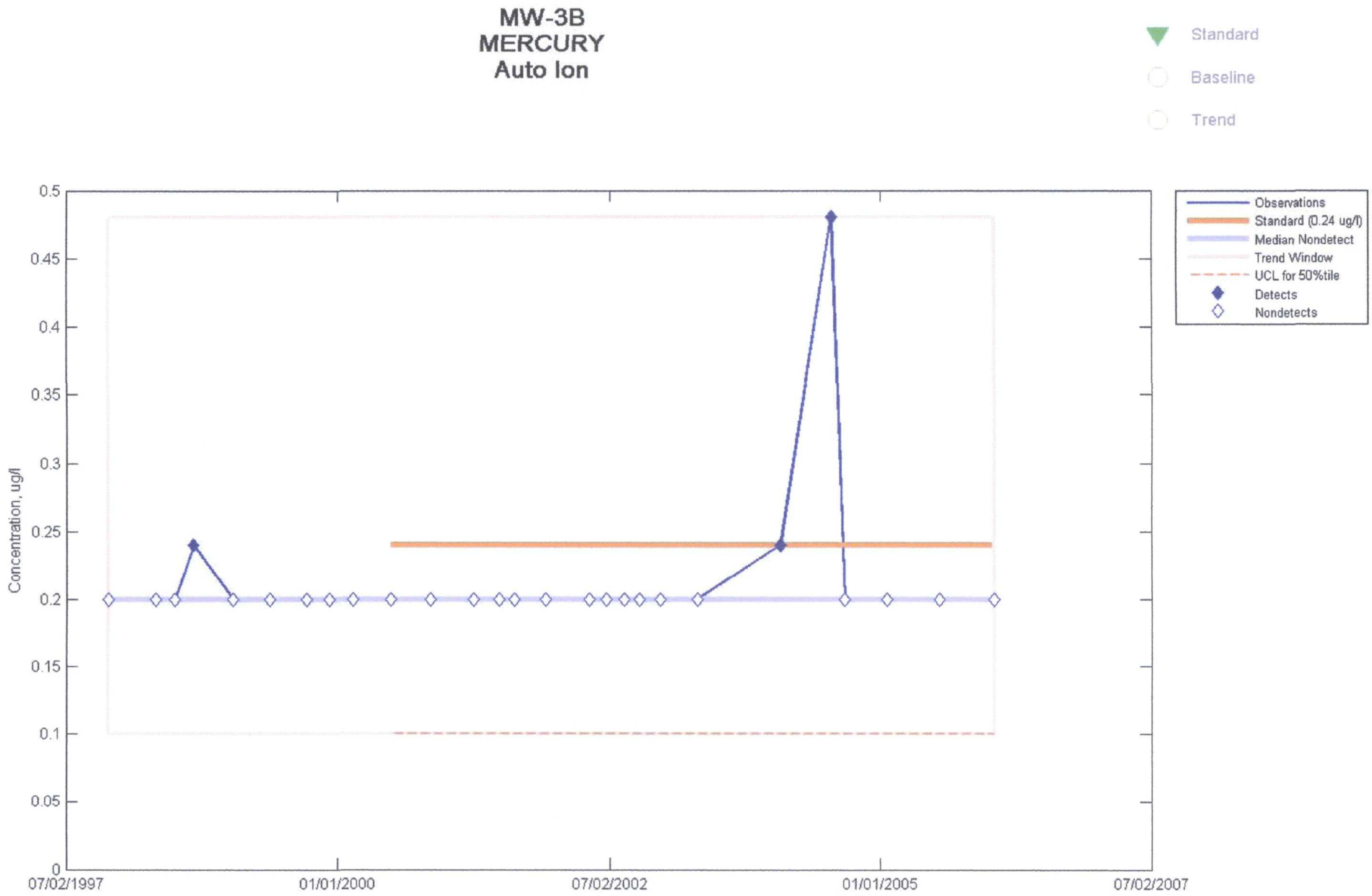
MW-3A
MERCURY
Auto Ion



Standard Test (95%): Compliance <UCL = 1.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

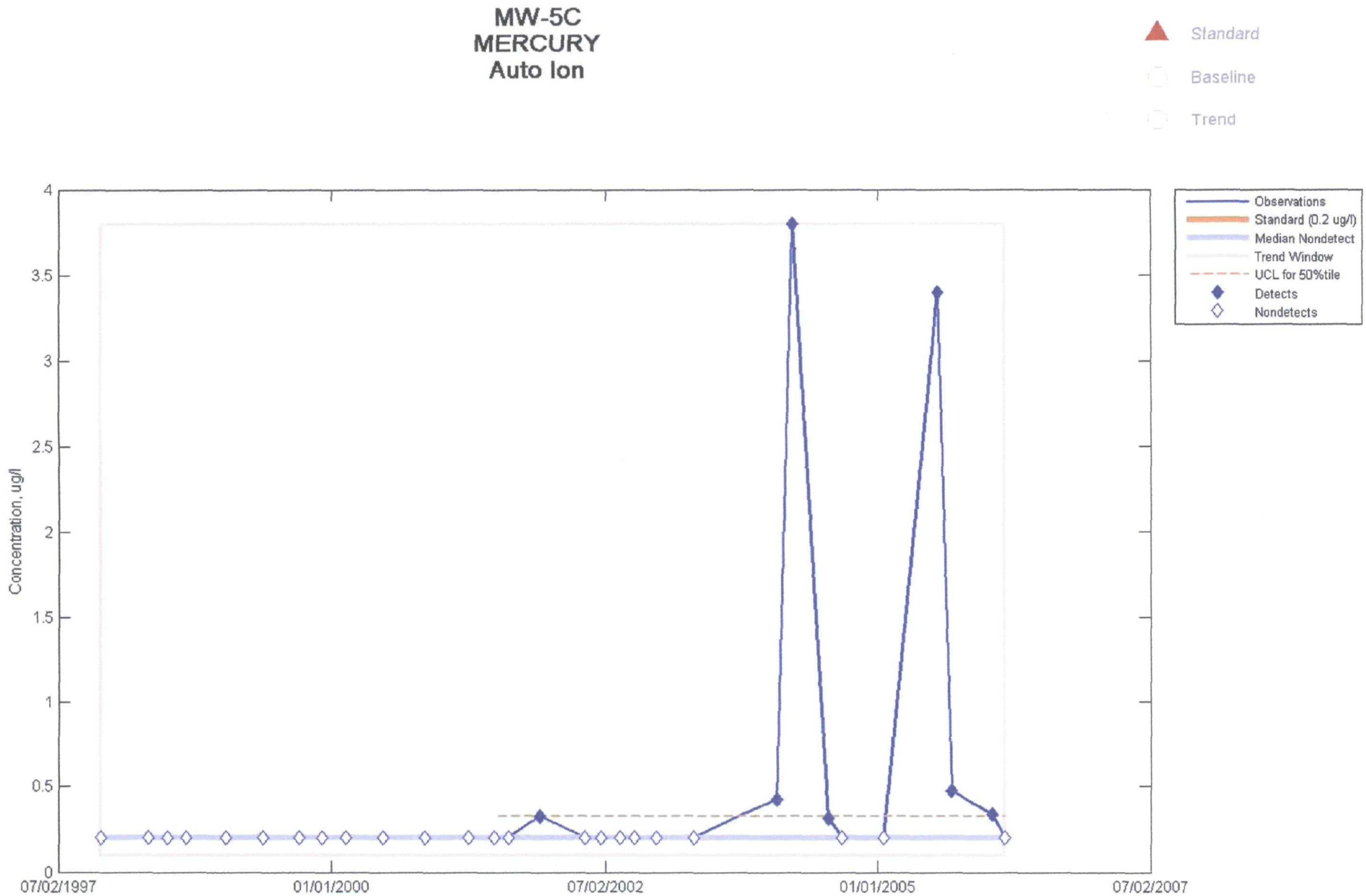
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 1.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

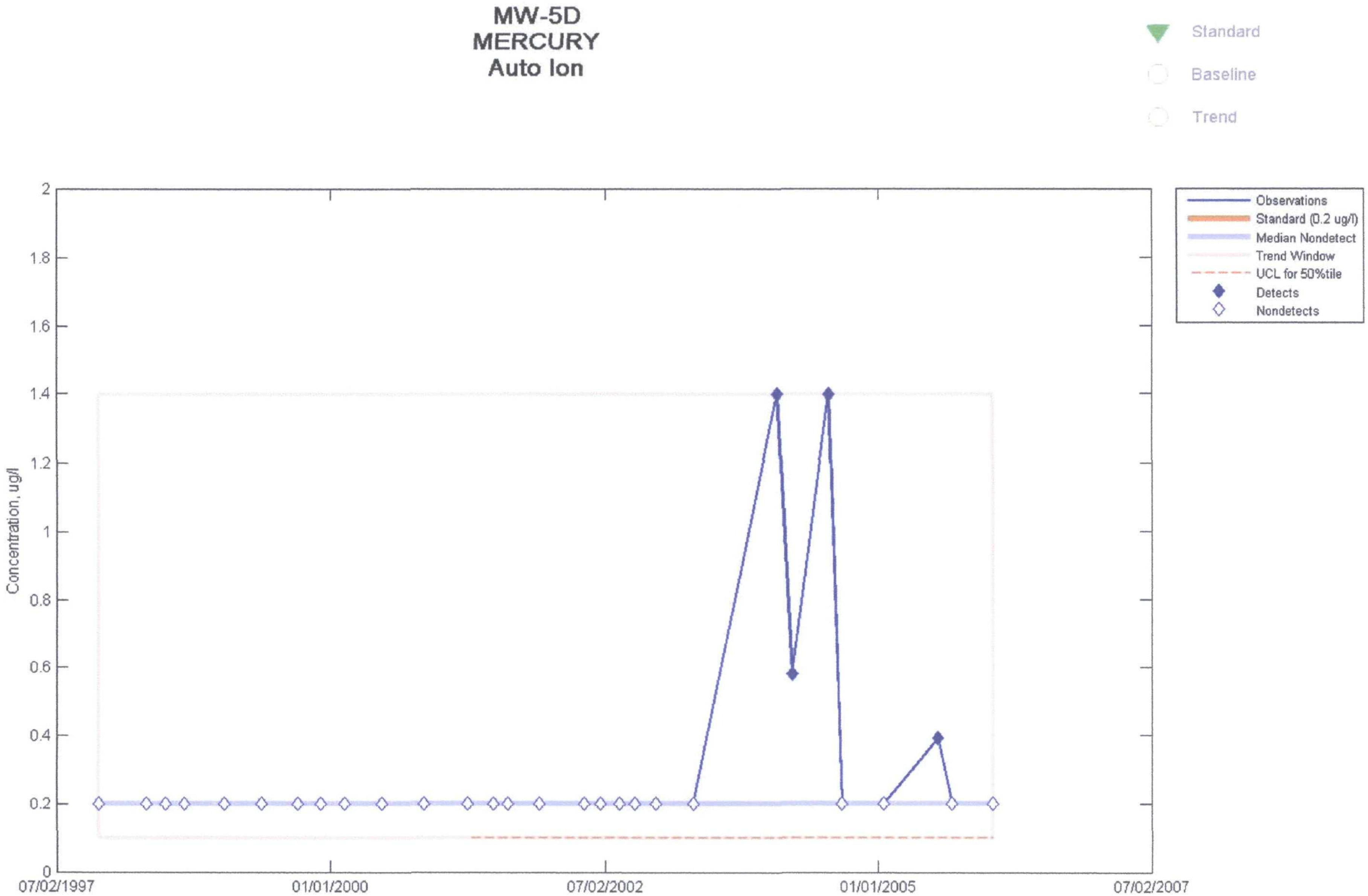
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Exceedance <UCL = 3.20e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

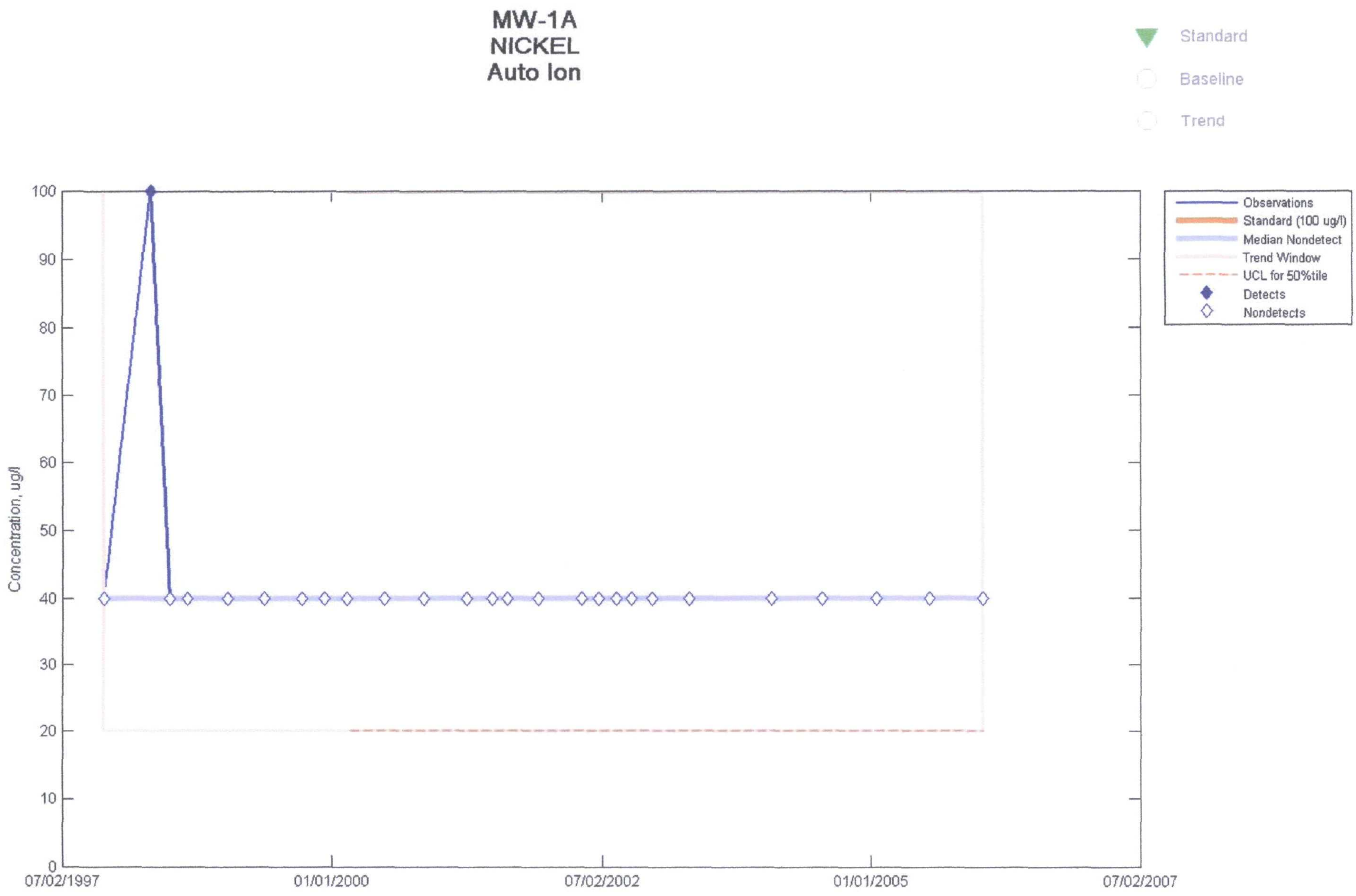
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 1.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

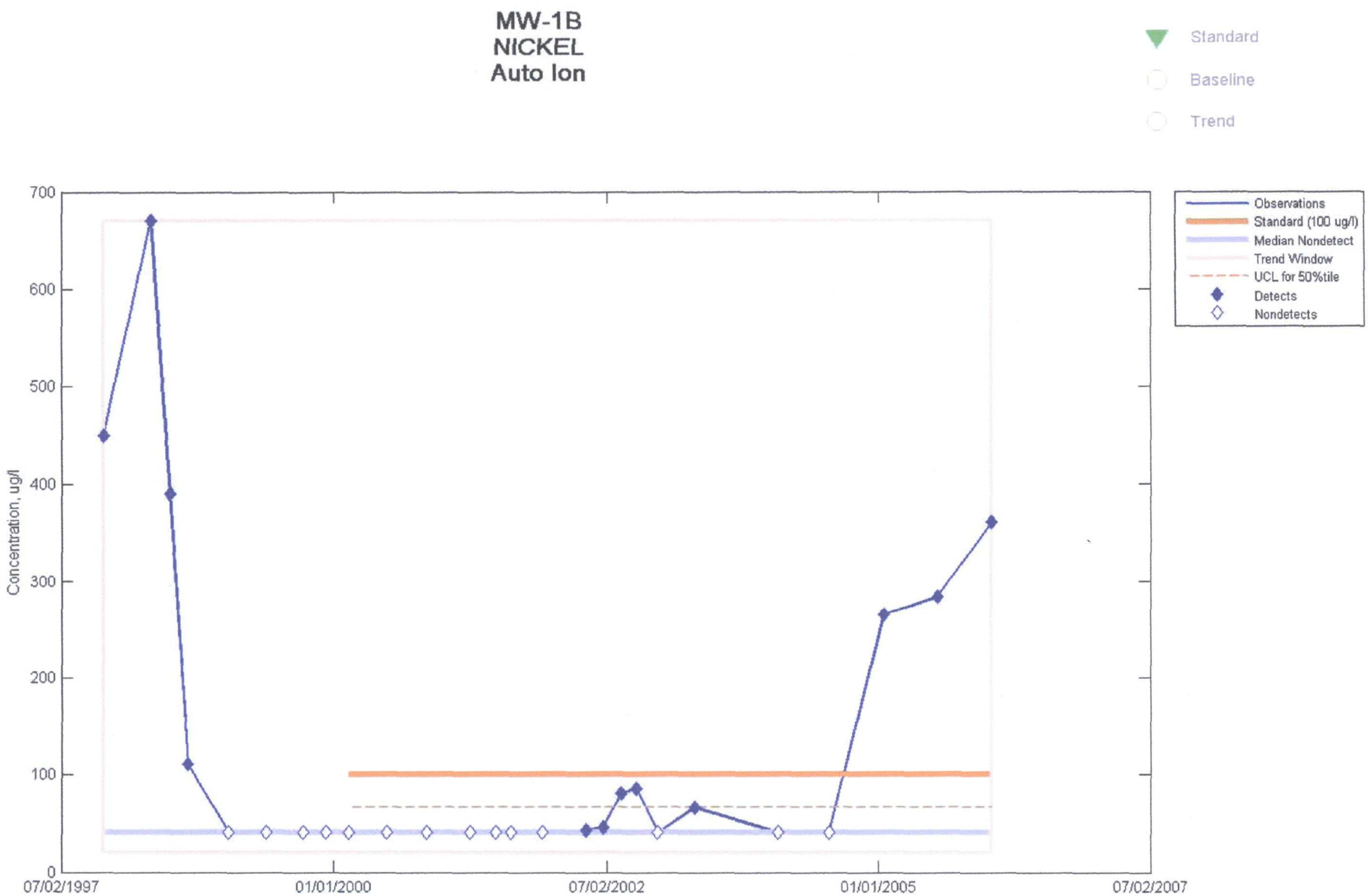
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 2.00e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

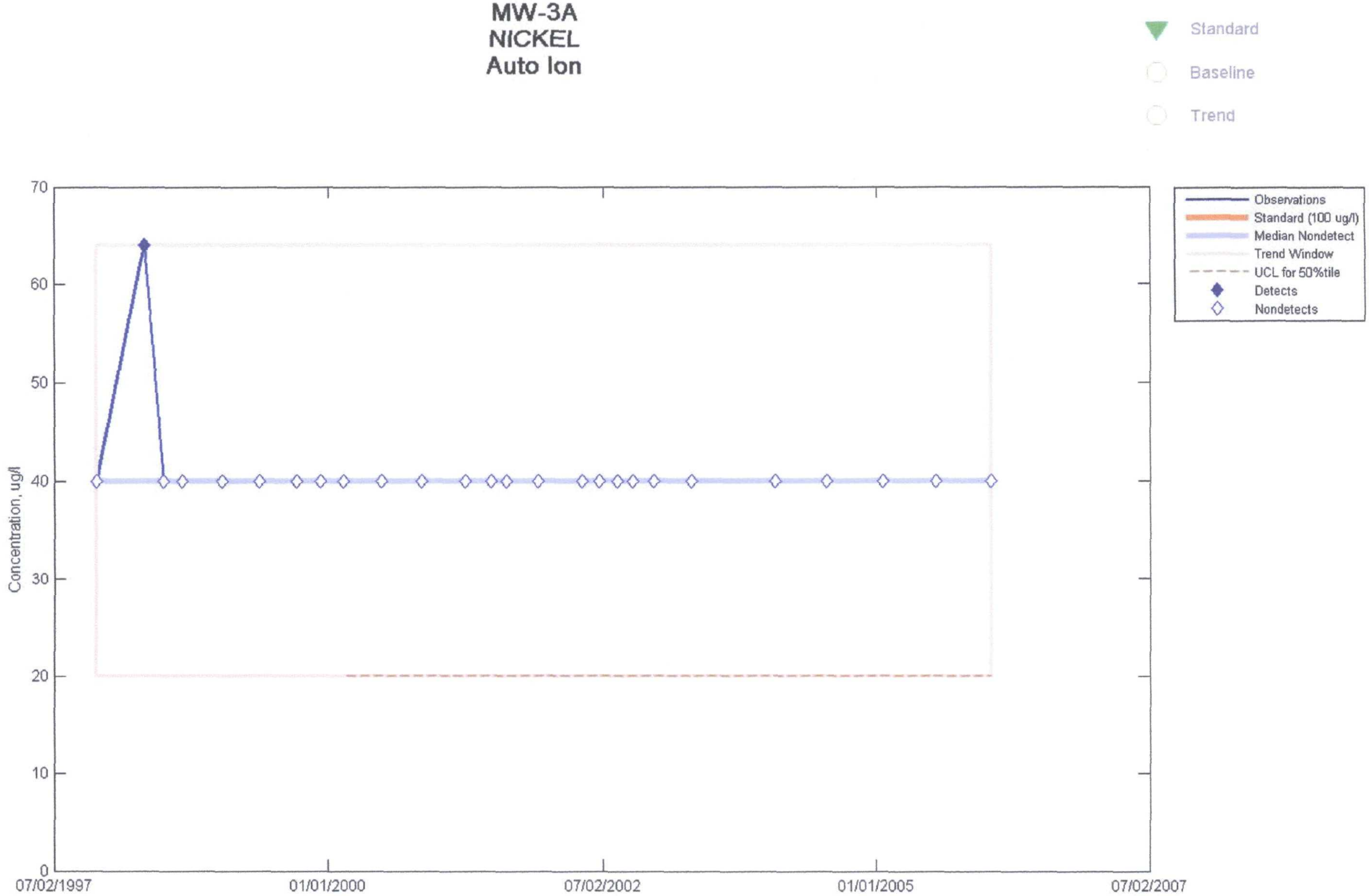


Standard Test (95%): Compliance <UCL = 6.54e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

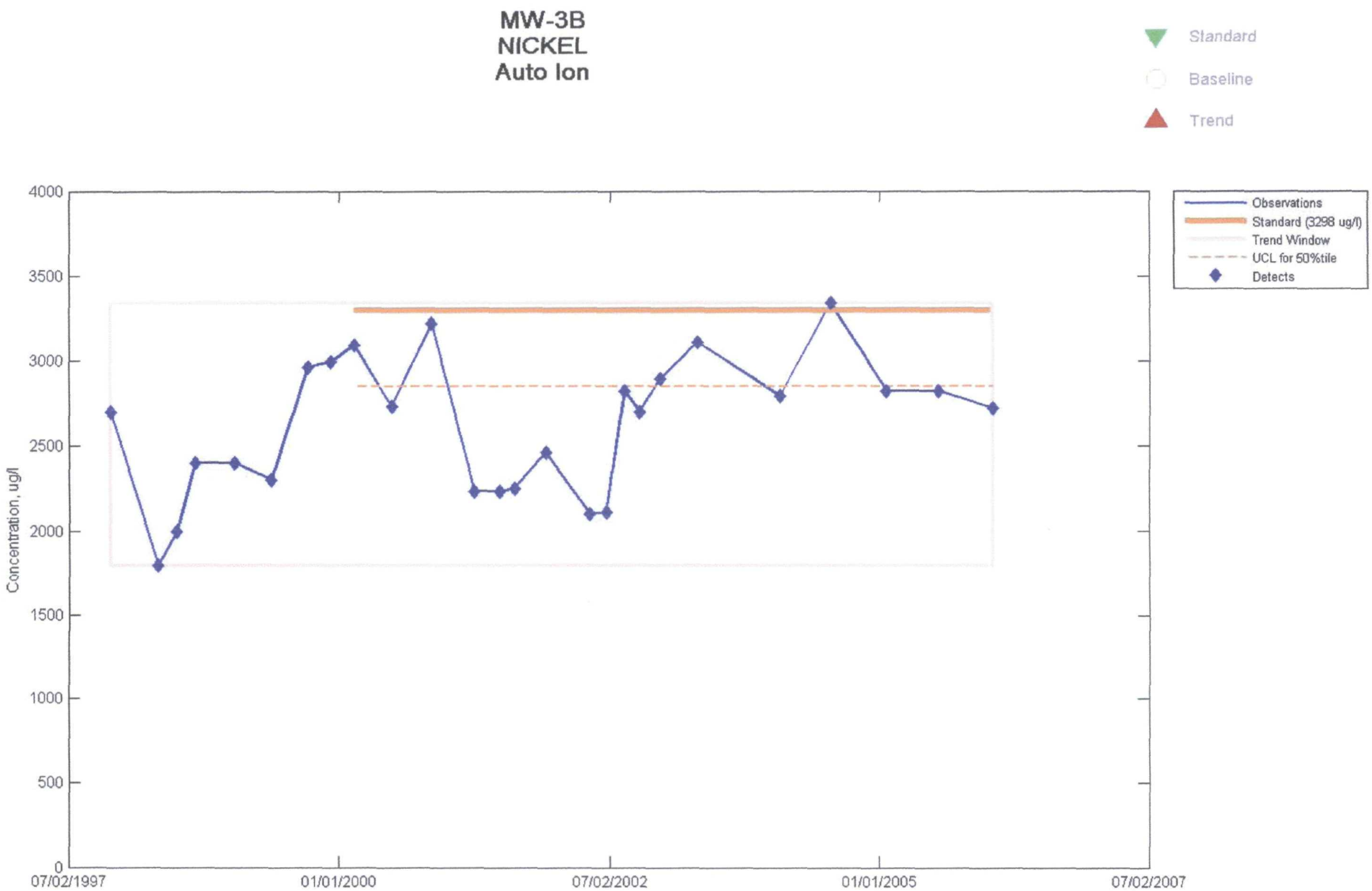
MW-3A
NICKEL
Auto Ion



Standard Test (95%): Compliance <UCL = 2.00e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

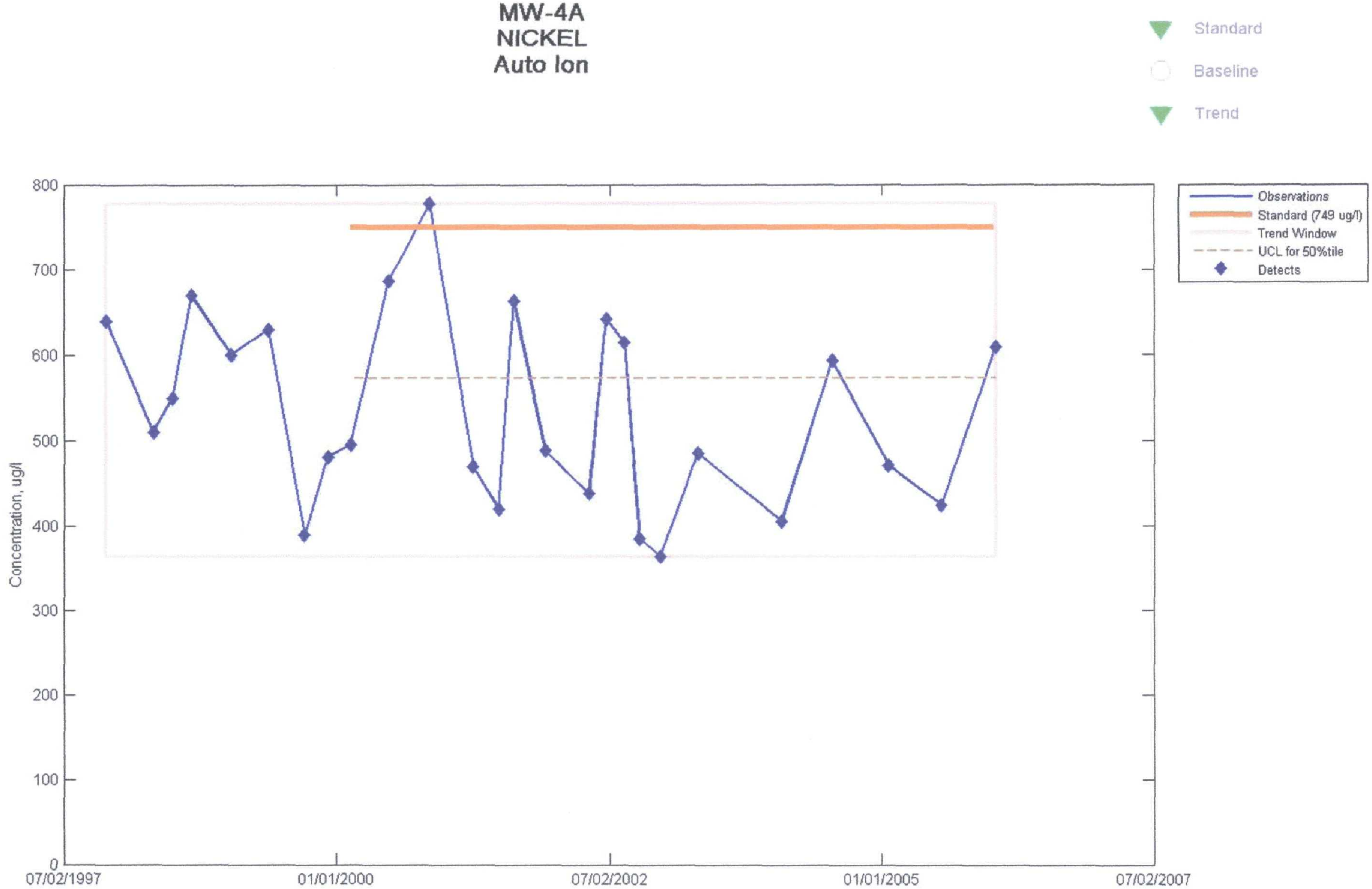


Standard Test (95%): Compliance <UCL = 2.85e+003 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Upward <Slope = 7.31e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

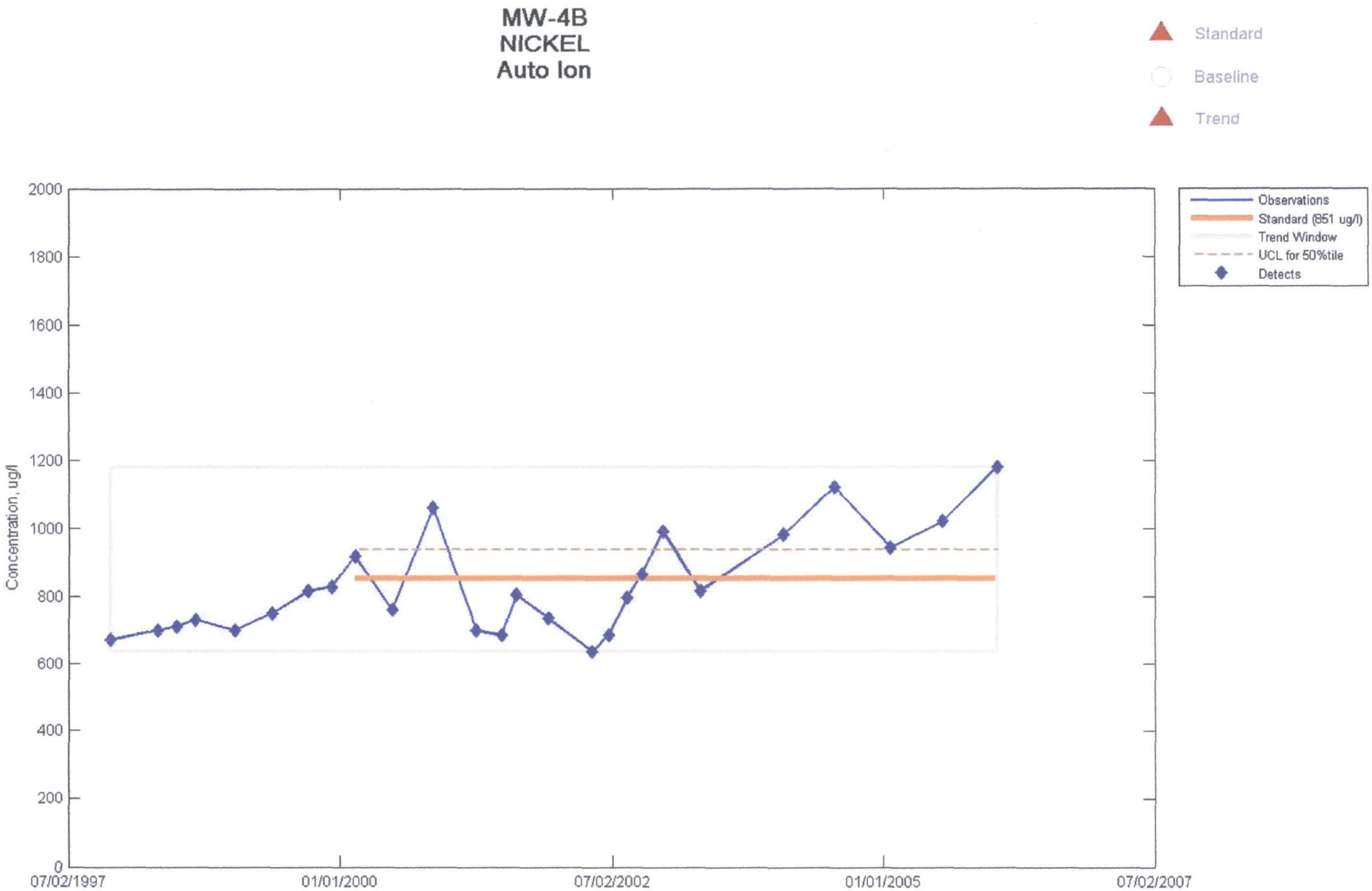
MW-4A
NICKEL
Auto Ion



Standard Test (95%): Compliance <UCL = 5.72e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -1.40e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

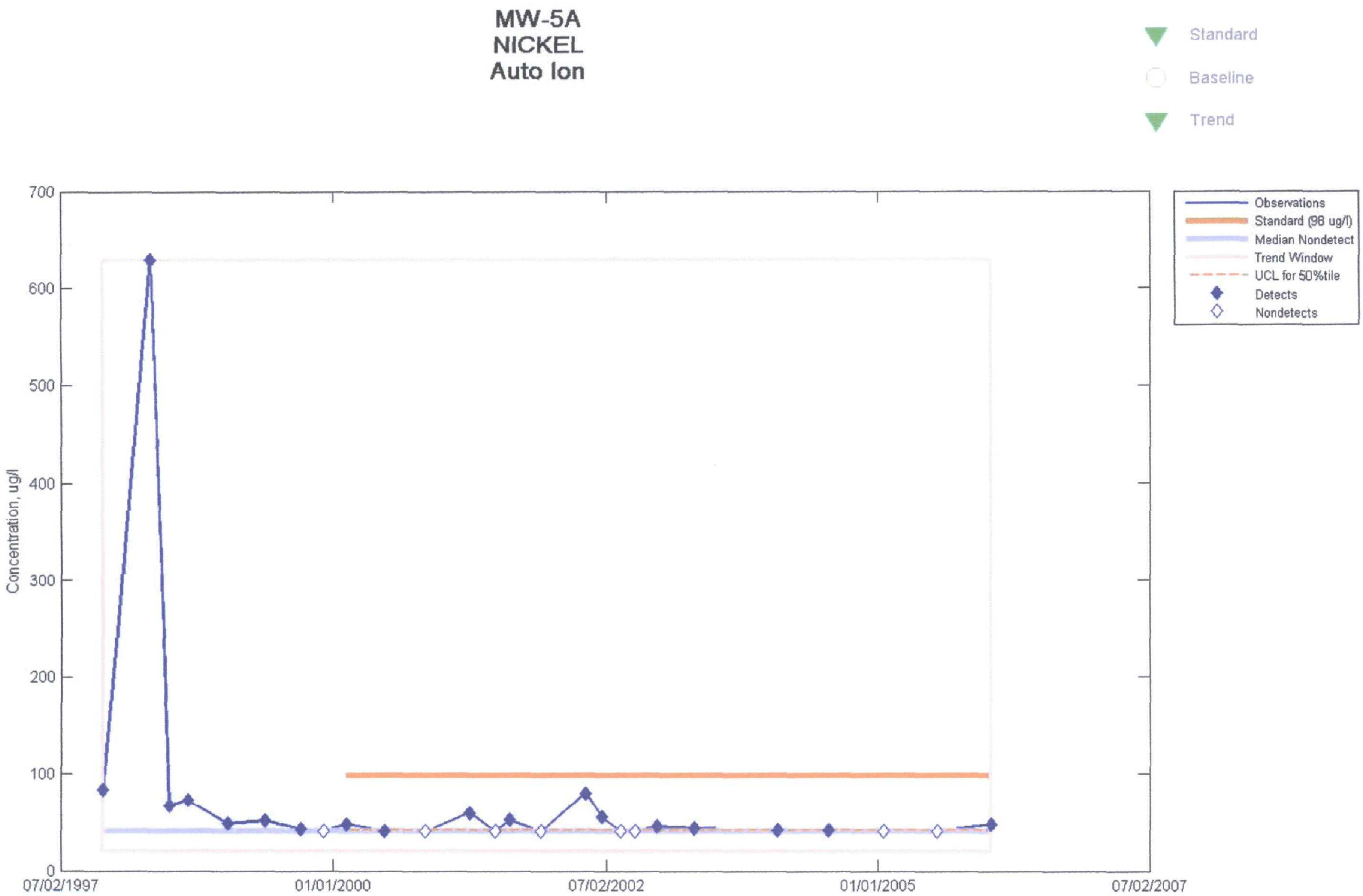
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Exceedance <UCL = 9.38e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Upward <Slope = 4.42e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

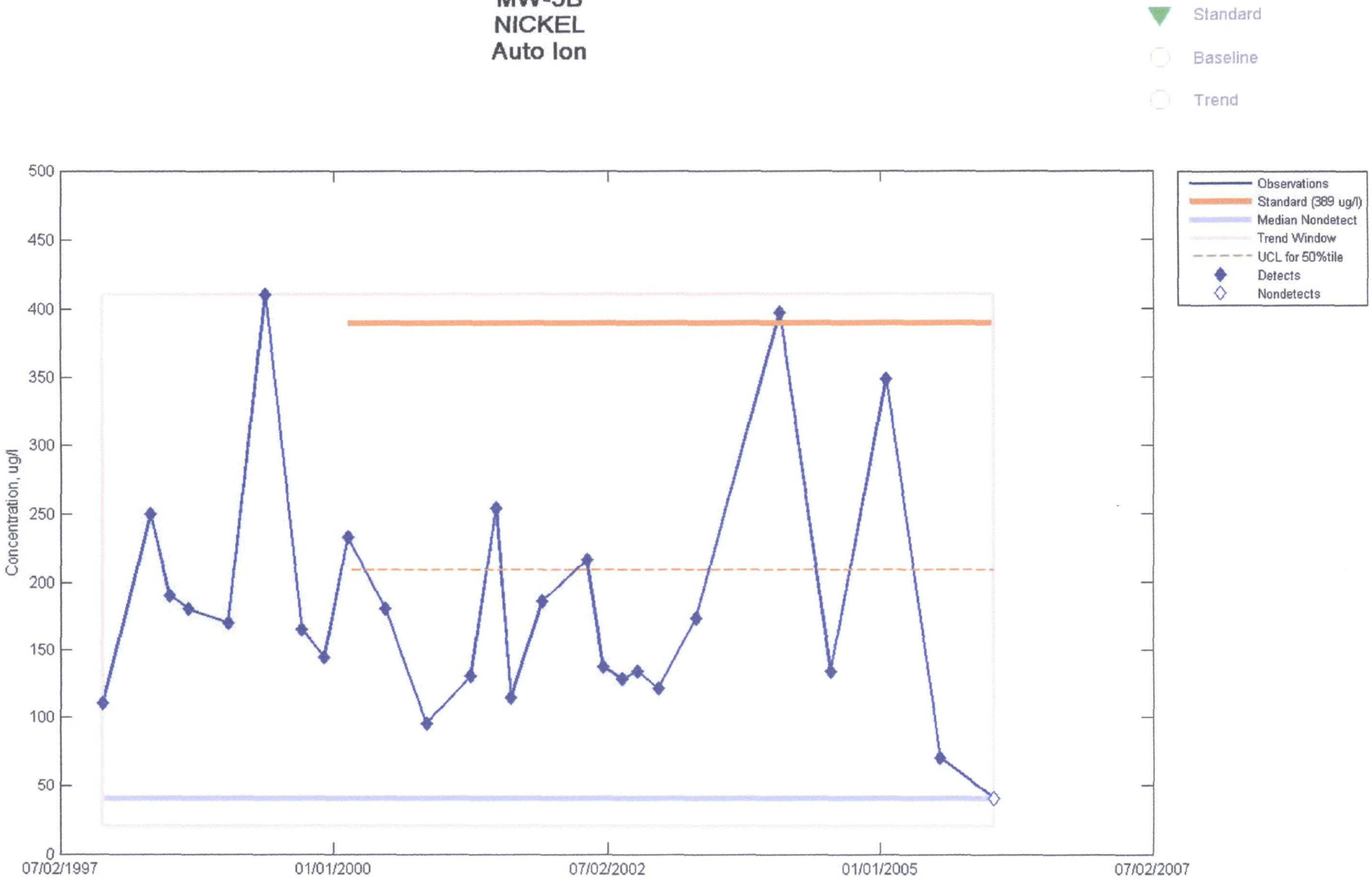


Standard Test (95%): Compliance <UCL = 4.16e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -4.80e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

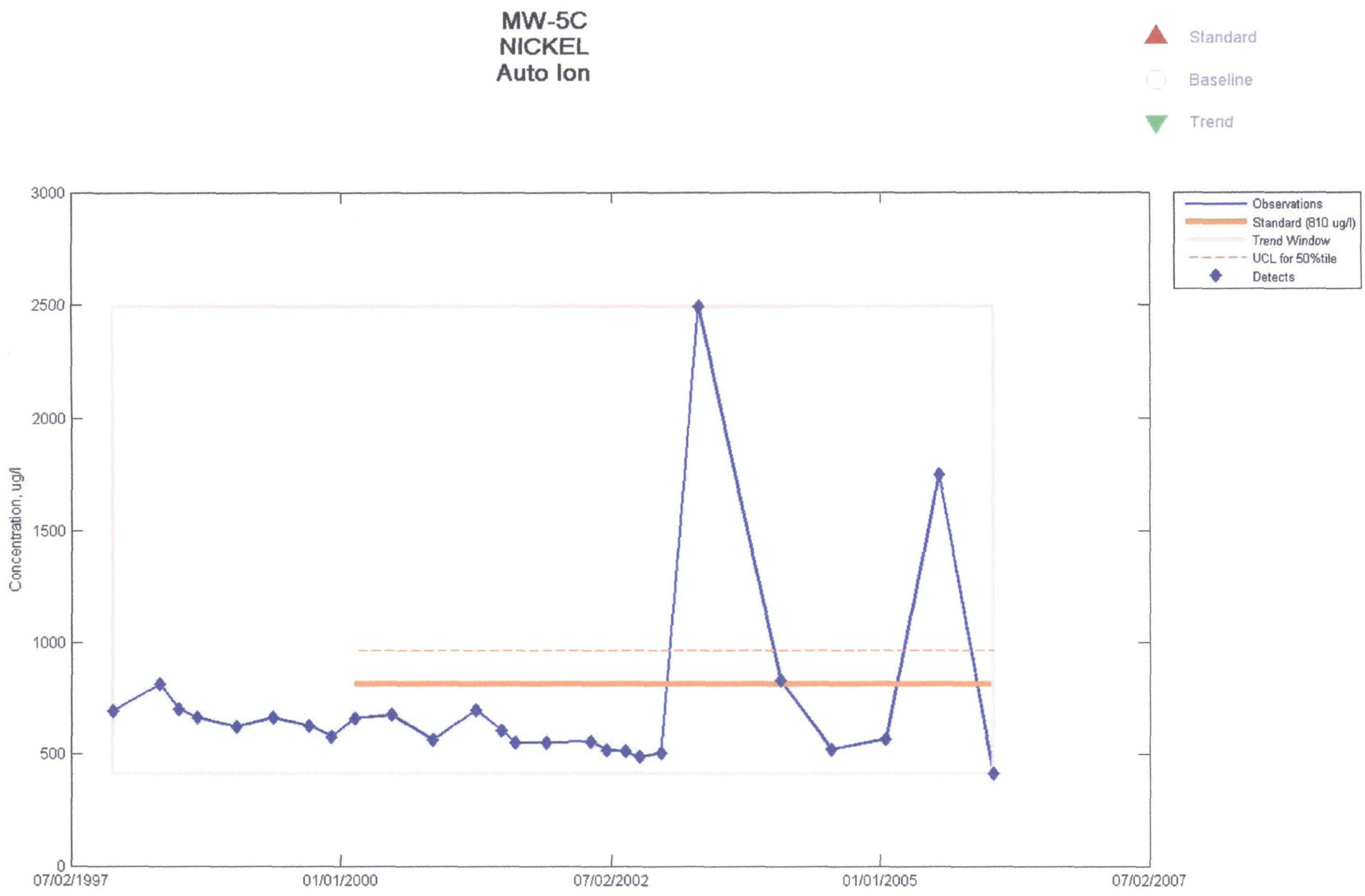
MW-5B
NICKEL
Auto Ion



Standard Test (95%): Compliance <UCL = 2.08e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = -1.05e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

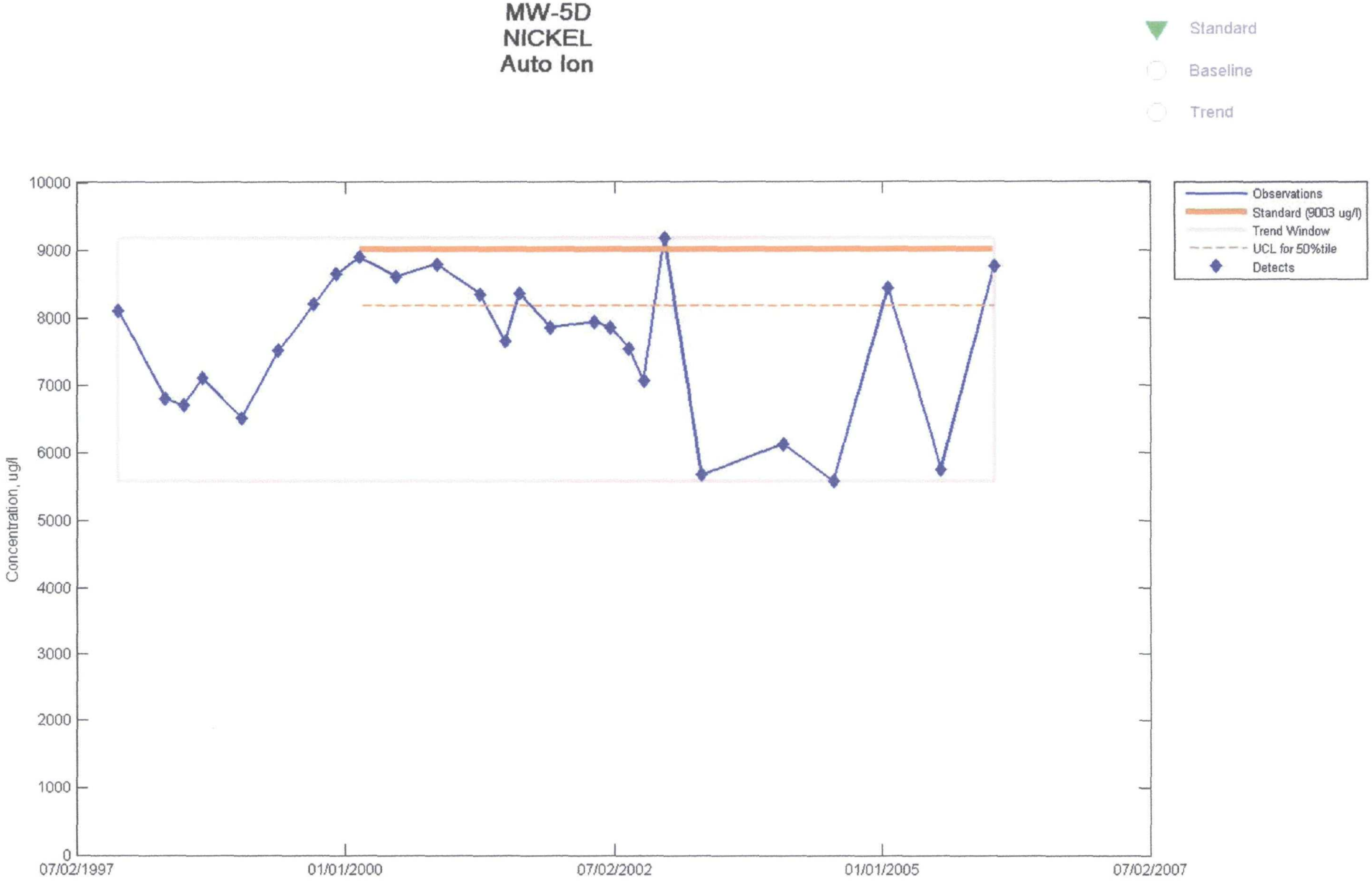


Standard Test (95%): Exceedance <UCL = 9.60e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -2.94e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

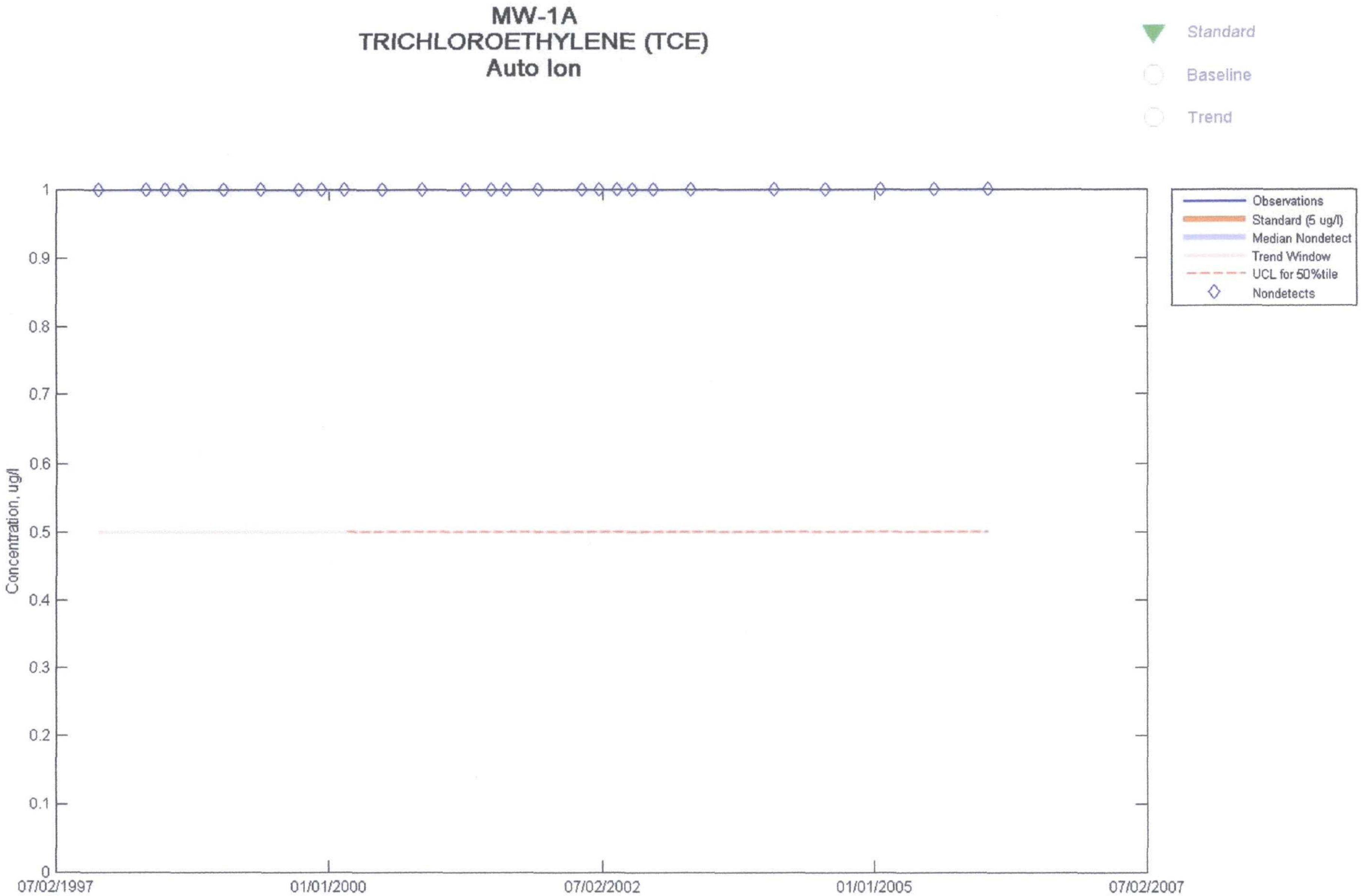
MW-5D
NICKEL
Auto Ion



Standard Test (95%): Compliance <UCL = 8.17e+003 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = -5.97e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

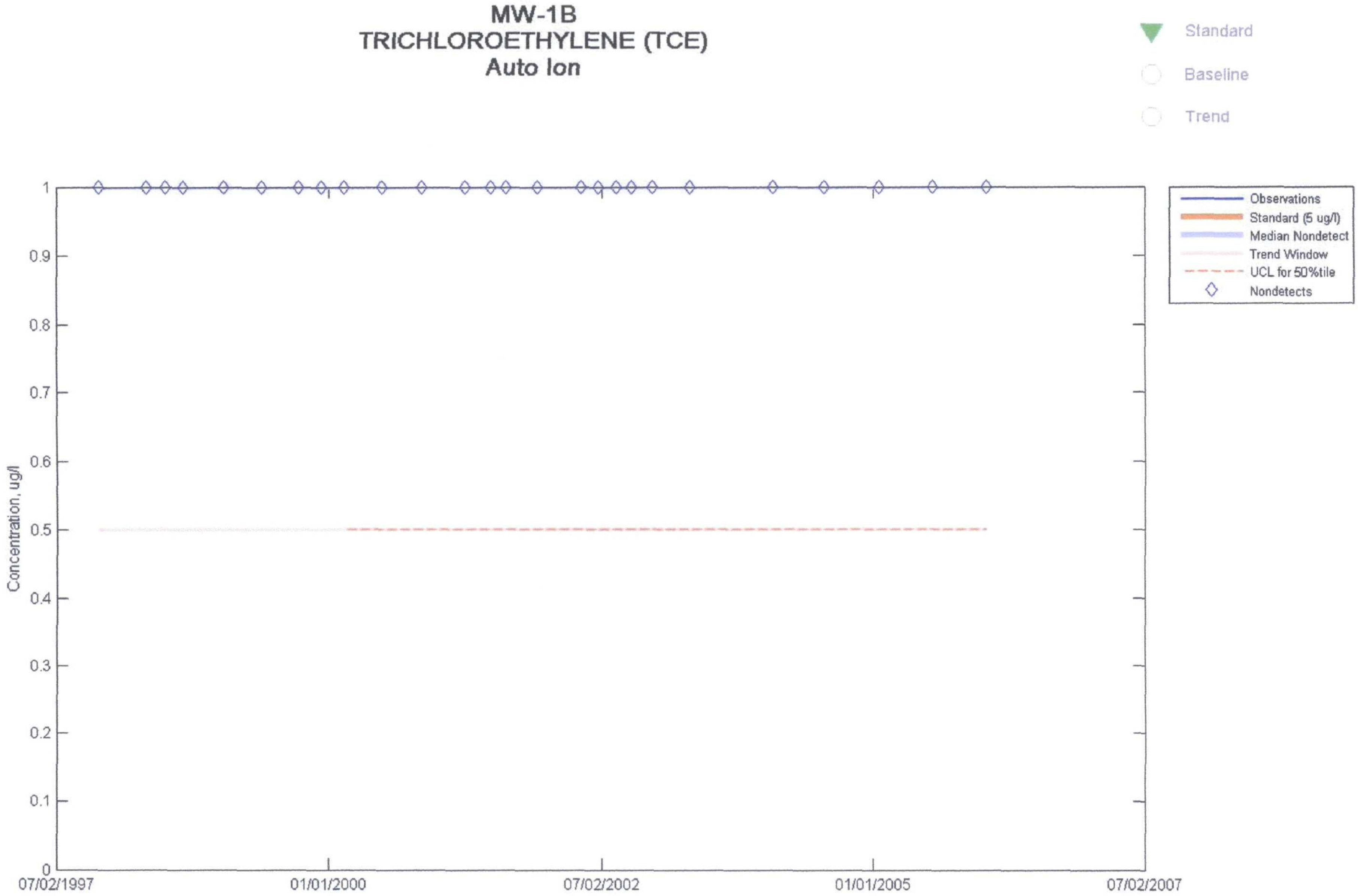
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

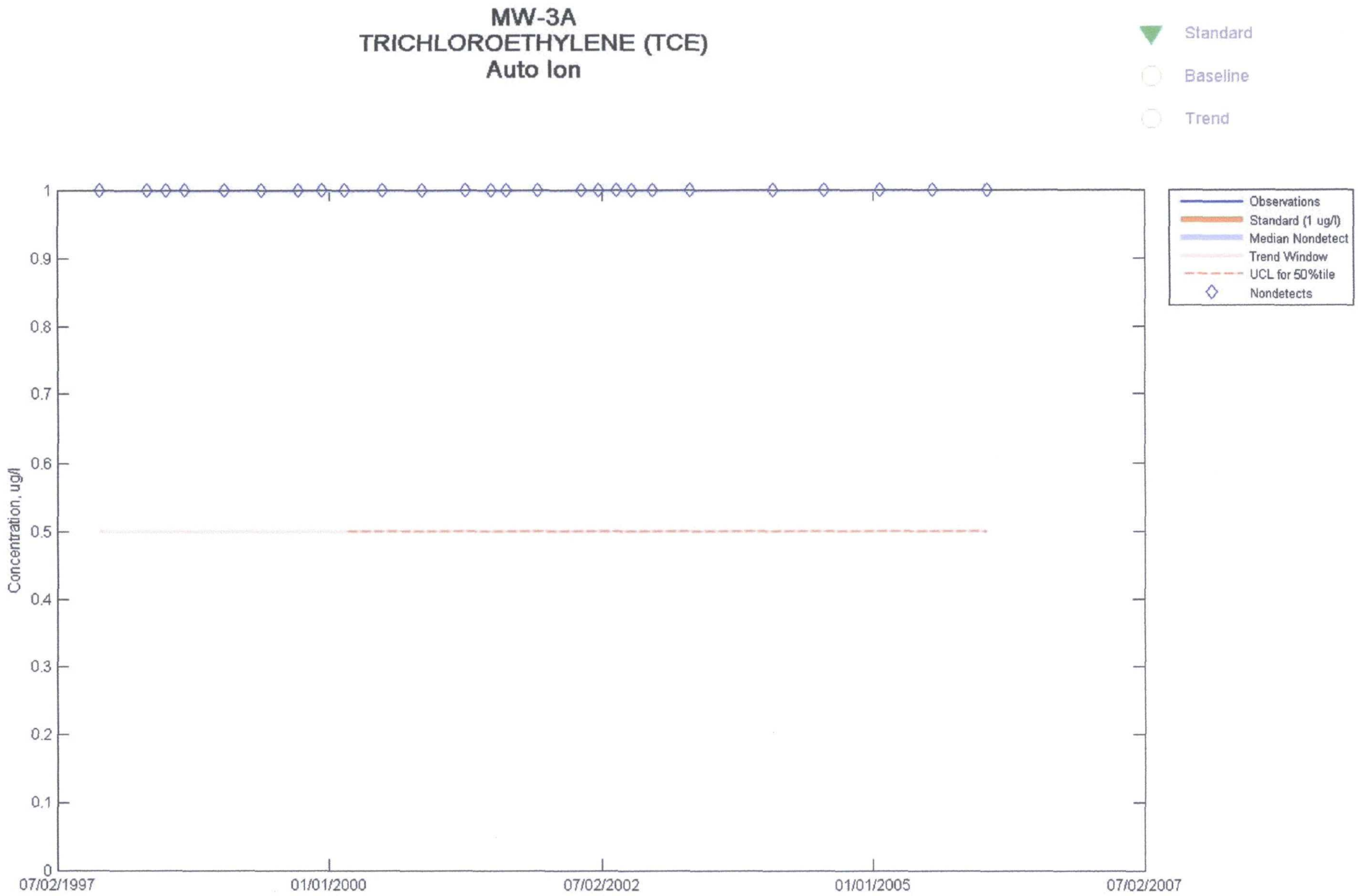
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

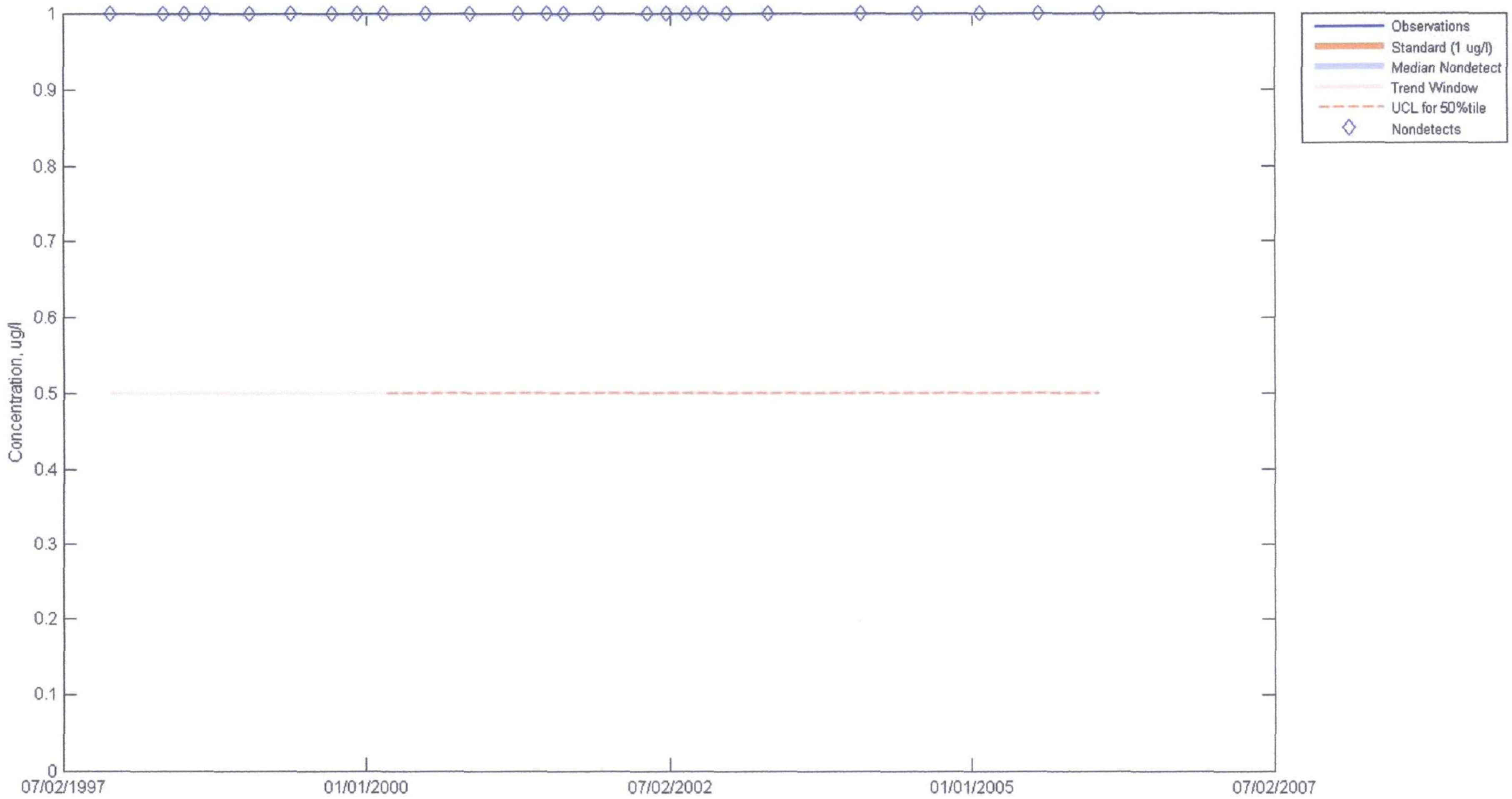
Run Date: 13-Jun-2006
Prepared by: USEPA

MW-3B
TRICHLOROETHYLENE (TCE)
Auto Ion

Standard

Baseline

Trend

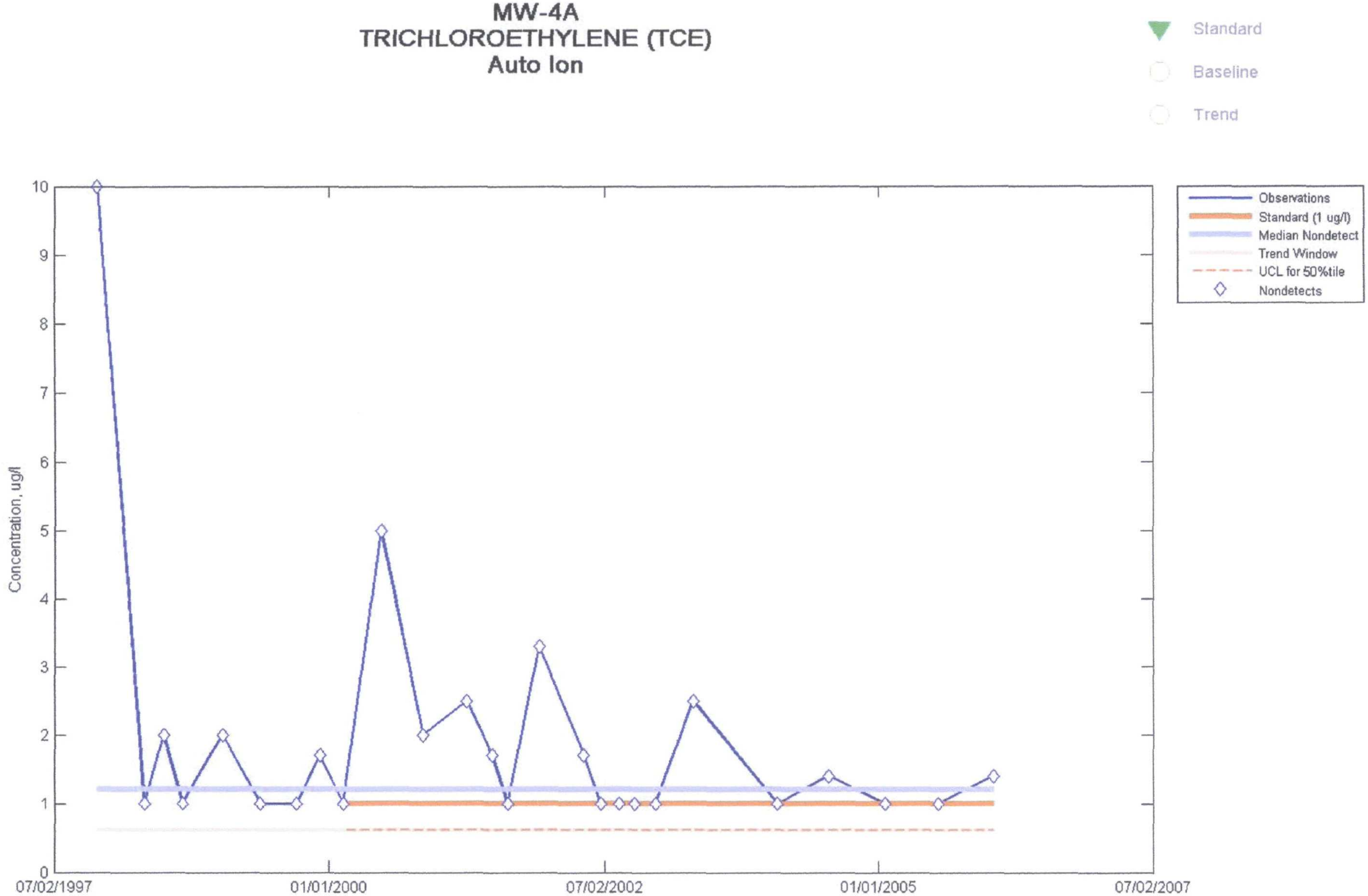


Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

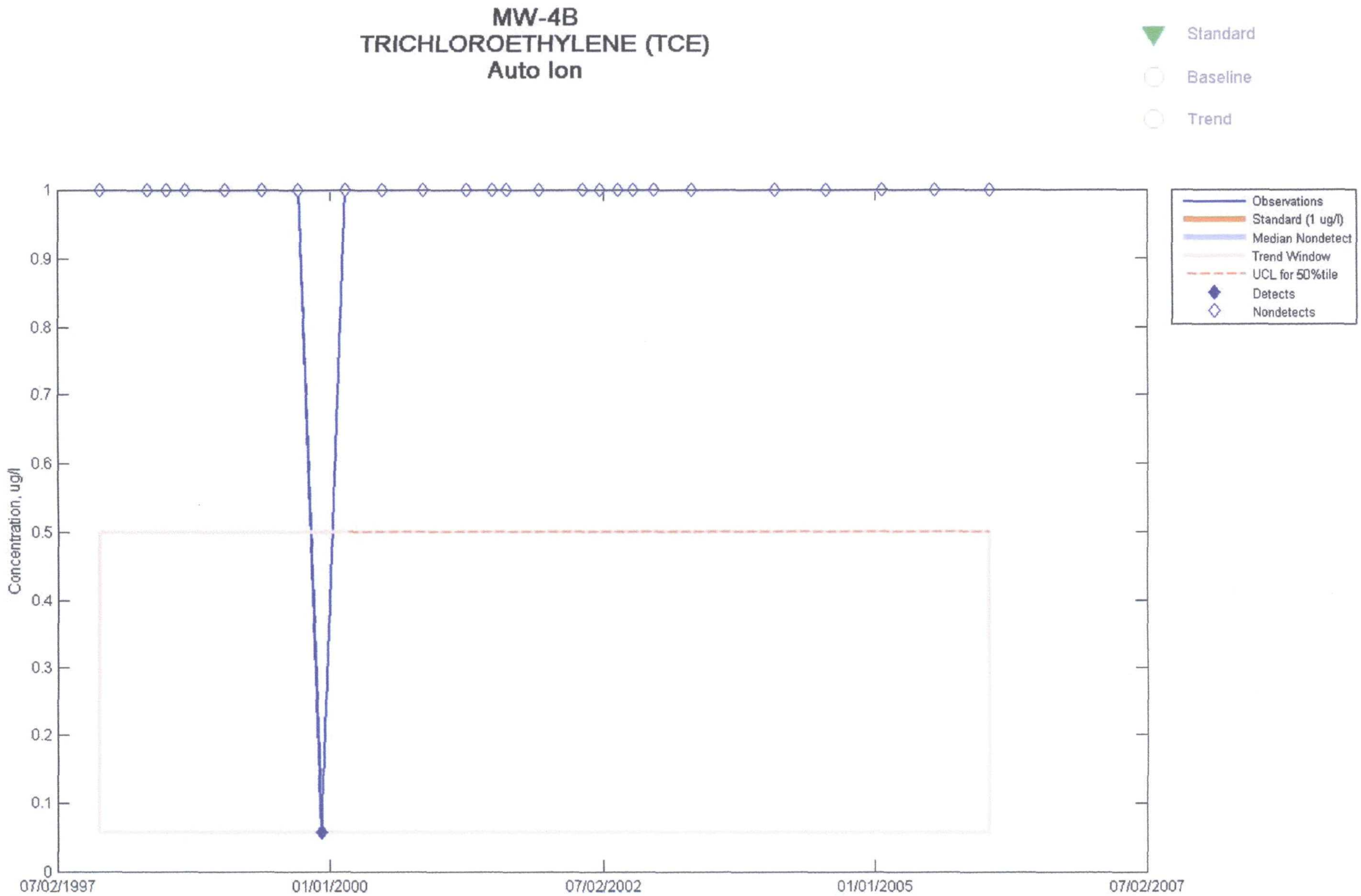
MW-4A
TRICHLOROETHYLENE (TCE)
Auto Ion



Standard Test (95%): Compliance <UCL = 6.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

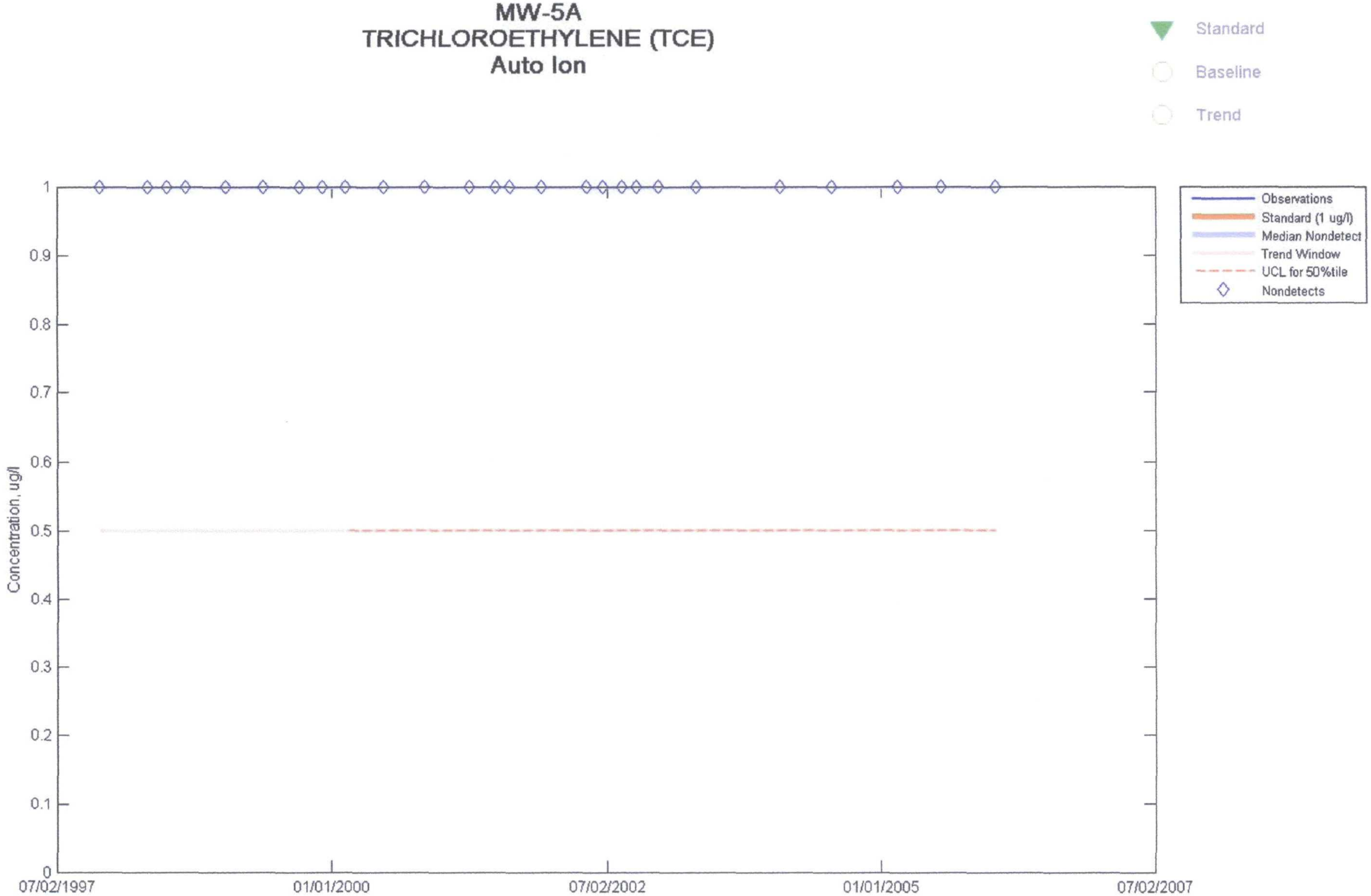


Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-5A
TRICHLOROETHYLENE (TCE)
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

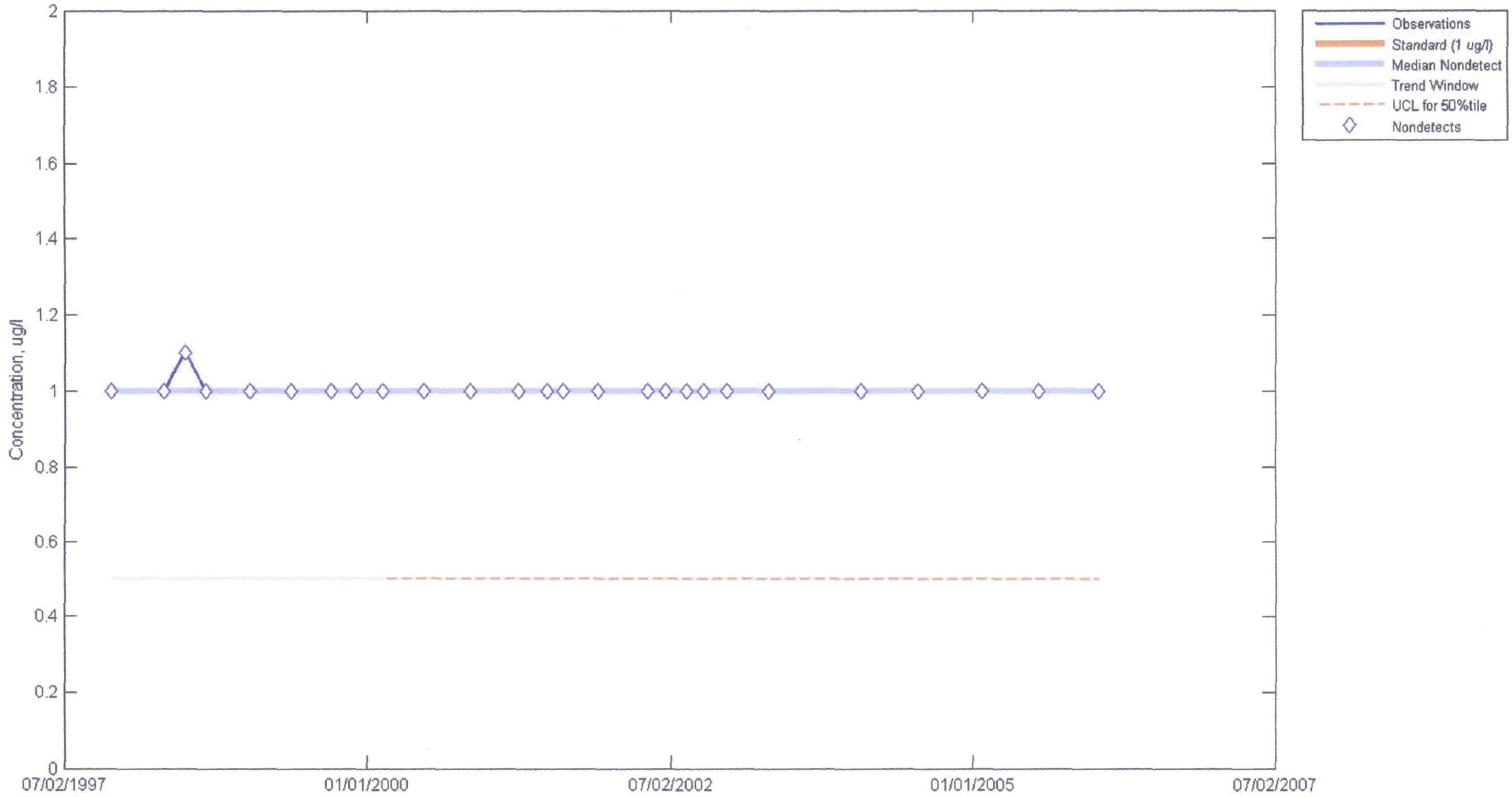
Run Date: 13-Jun-2006
Prepared by: USEPA

MW-5B
TRICHLOROETHYLENE (TCE)
Auto Ion

Standard

Baseline

Trend

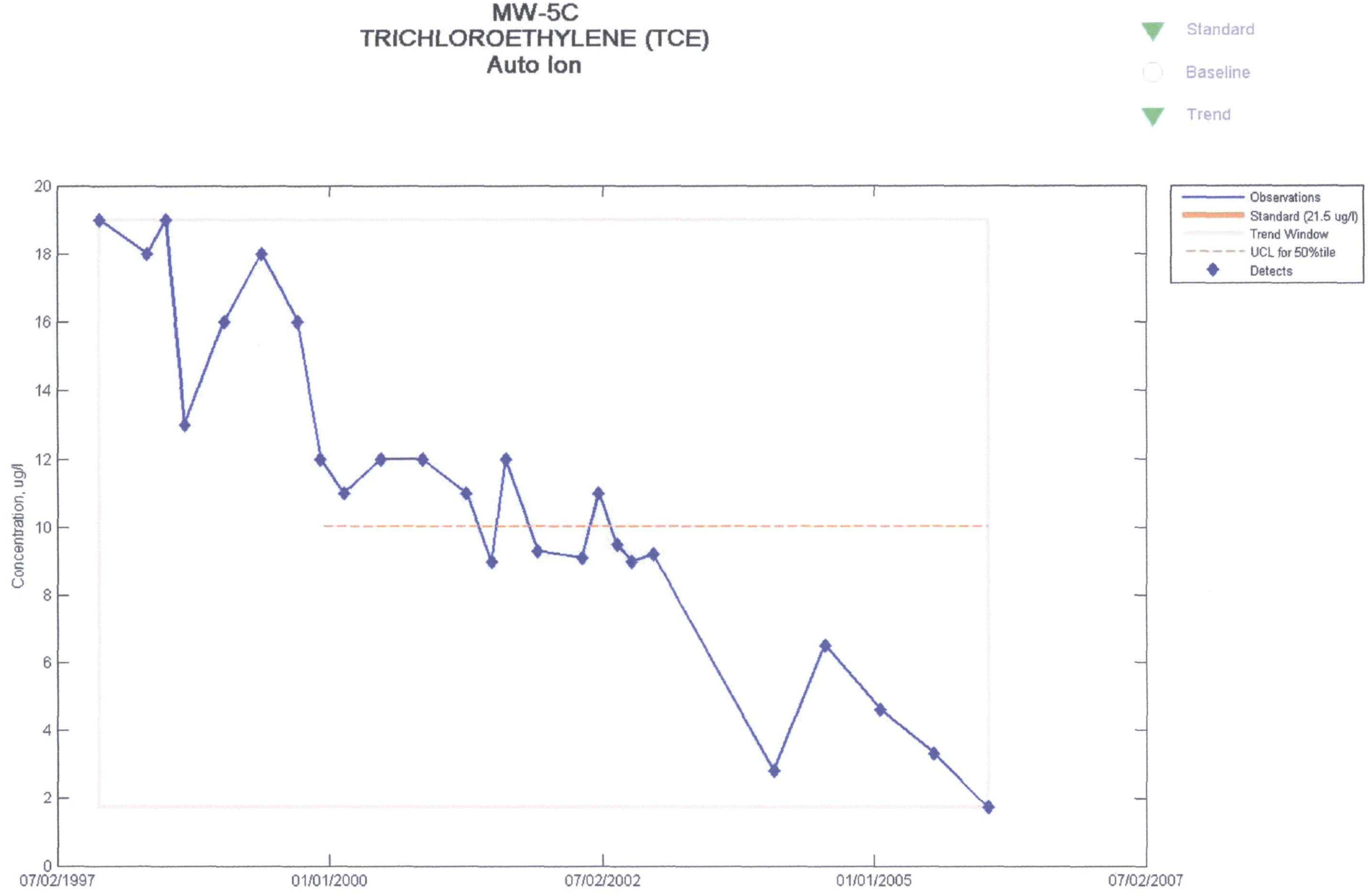


Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-5C
TRICHLOROETHYLENE (TCE)
Auto Ion

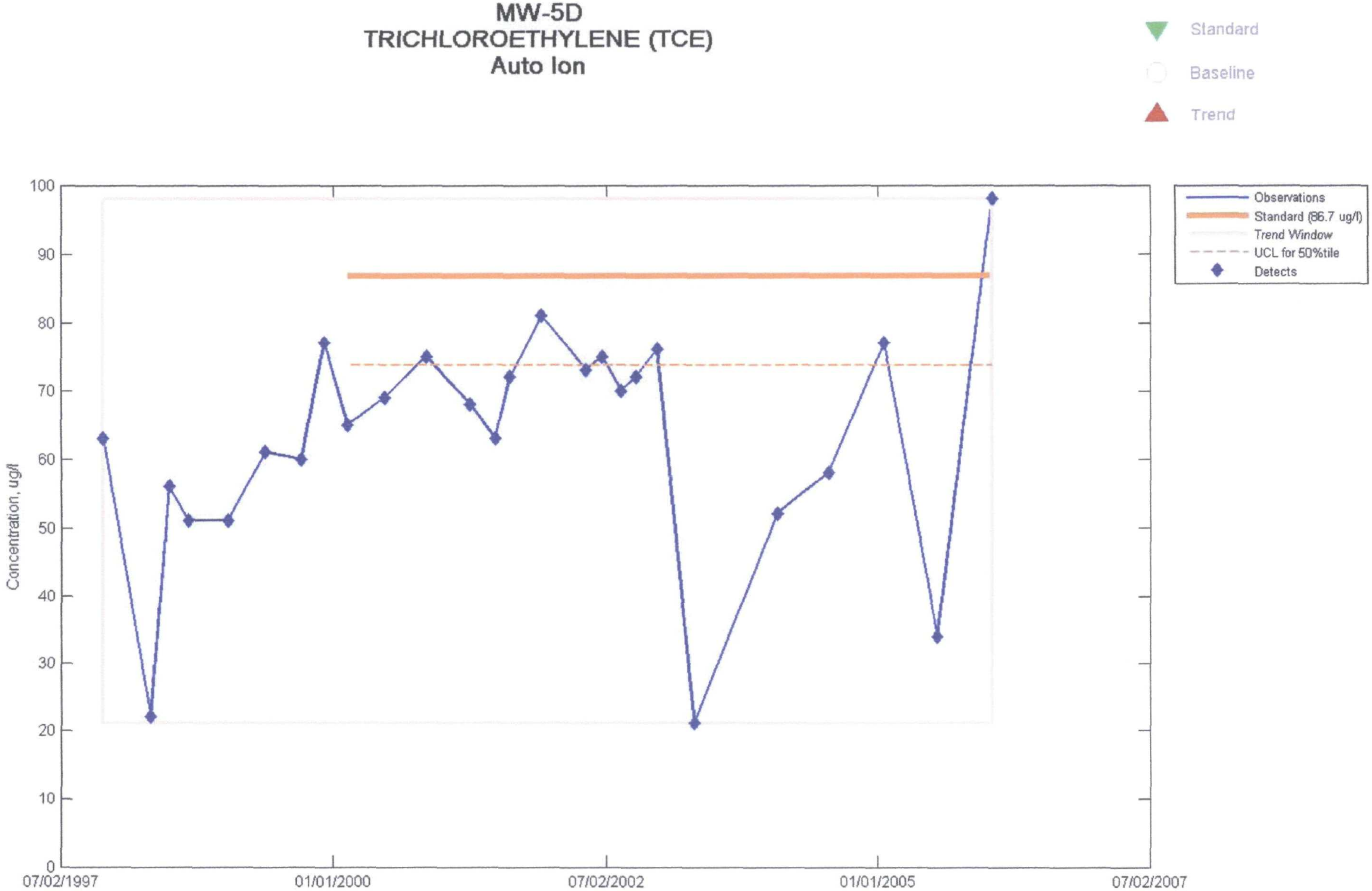


Standard Test (95%): Compliance <UCL = 1.00e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -1.98e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

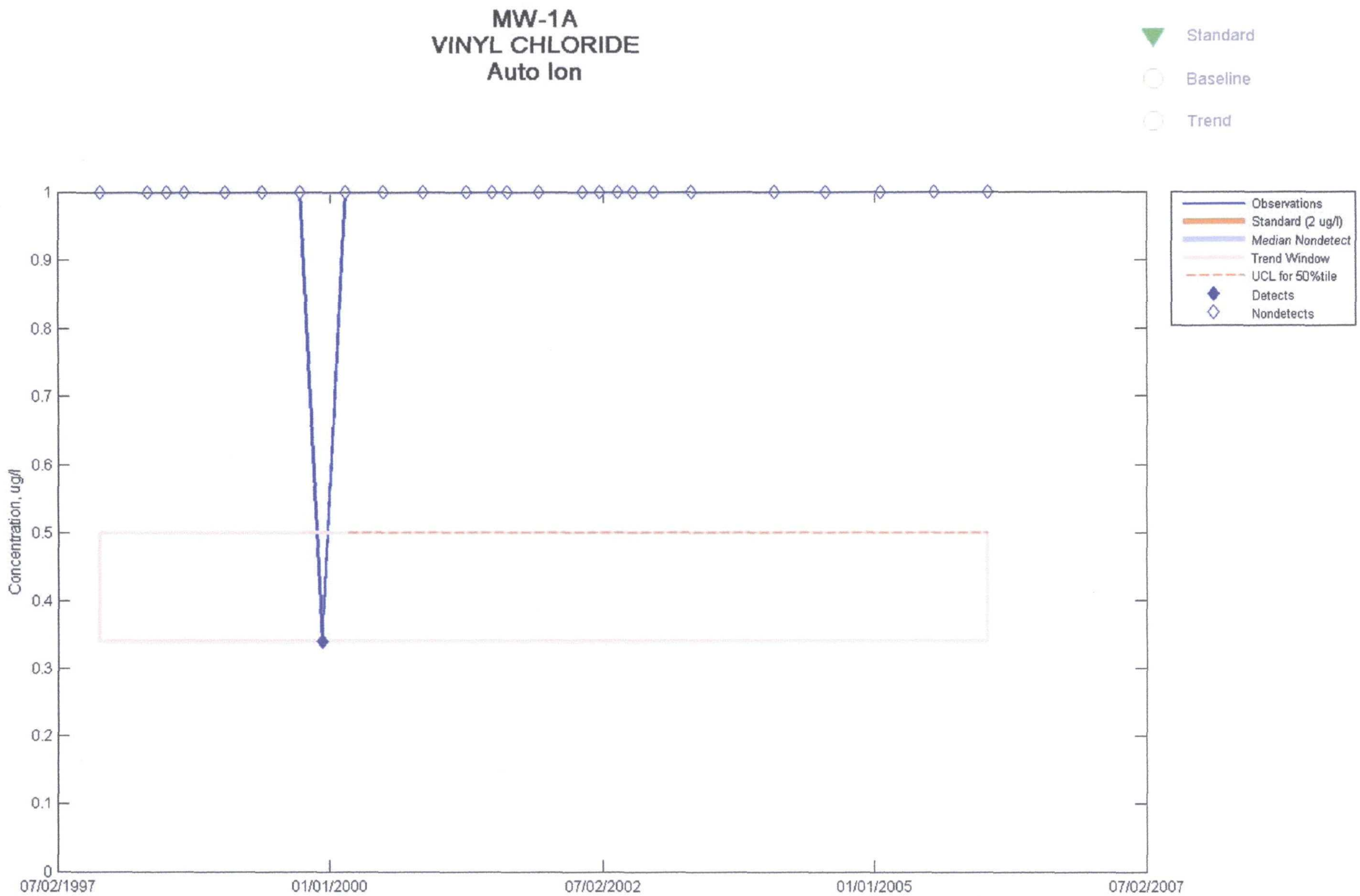
MW-5D
TRICHLOROETHYLENE (TCE)
Auto Ion



Standard Test (95%): Compliance <UCL = 7.37e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Upward <Slope = 2.76e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

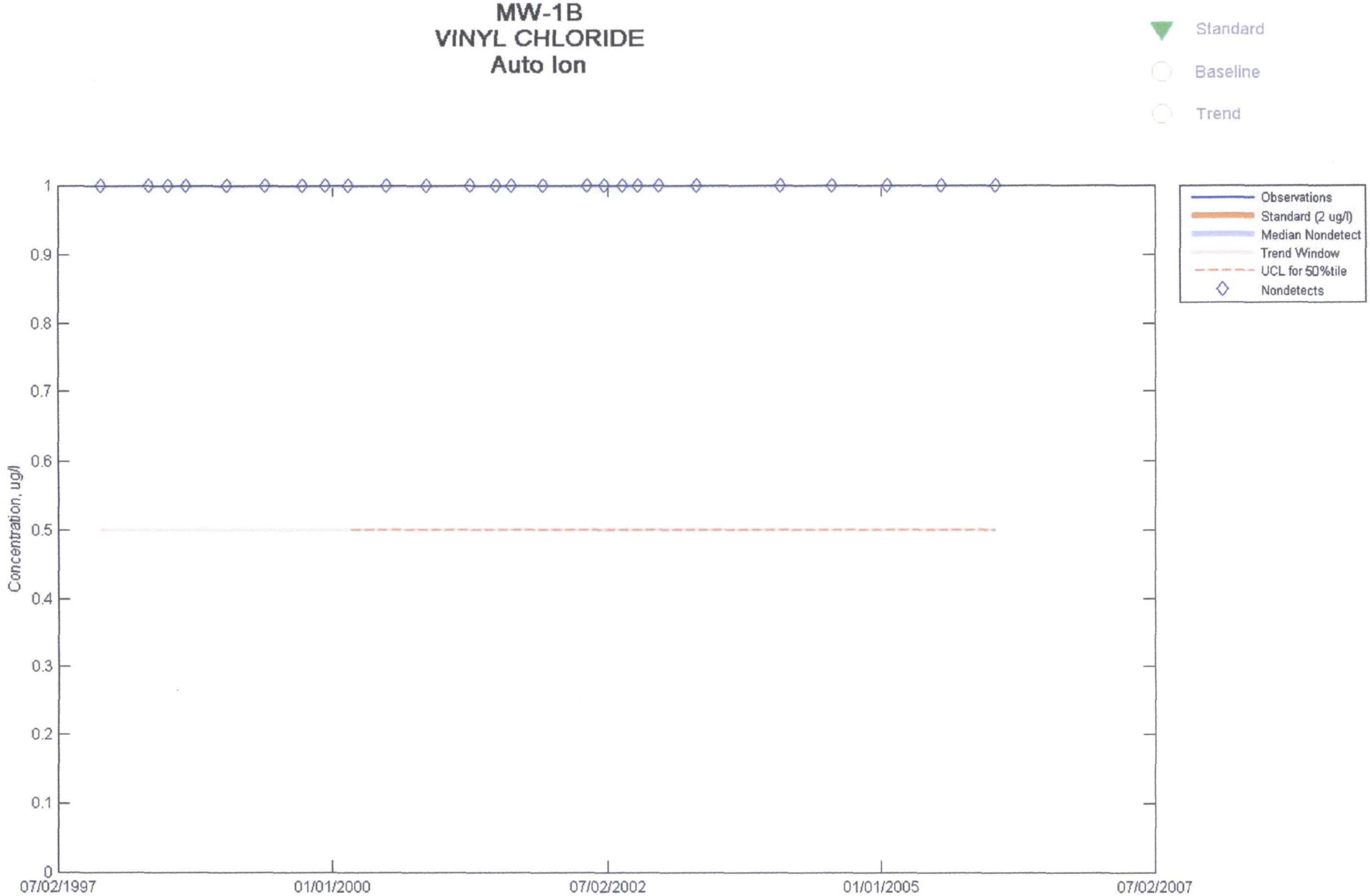


Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

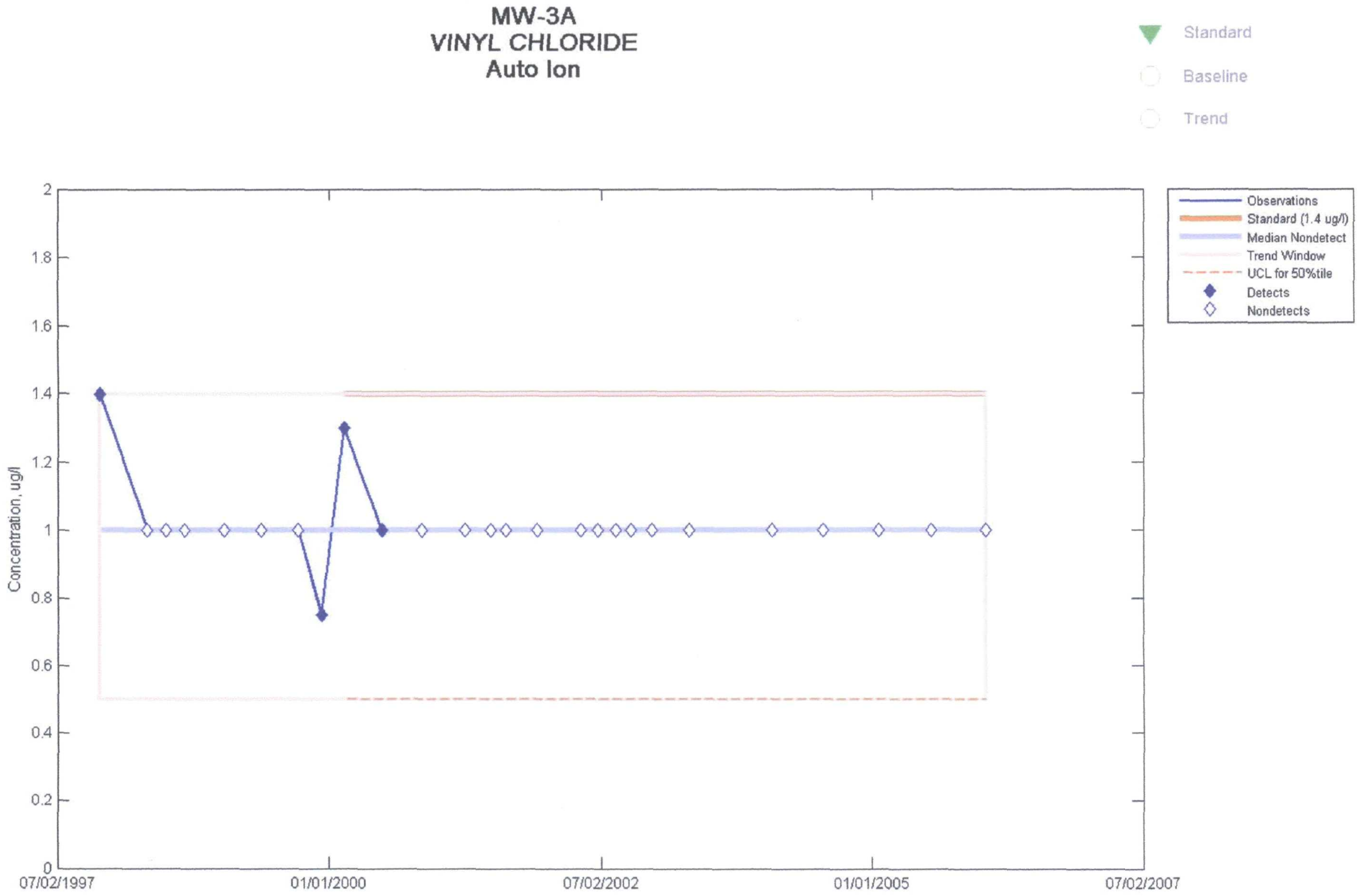
MW-1B
VINYL CHLORIDE
Auto Ion



Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

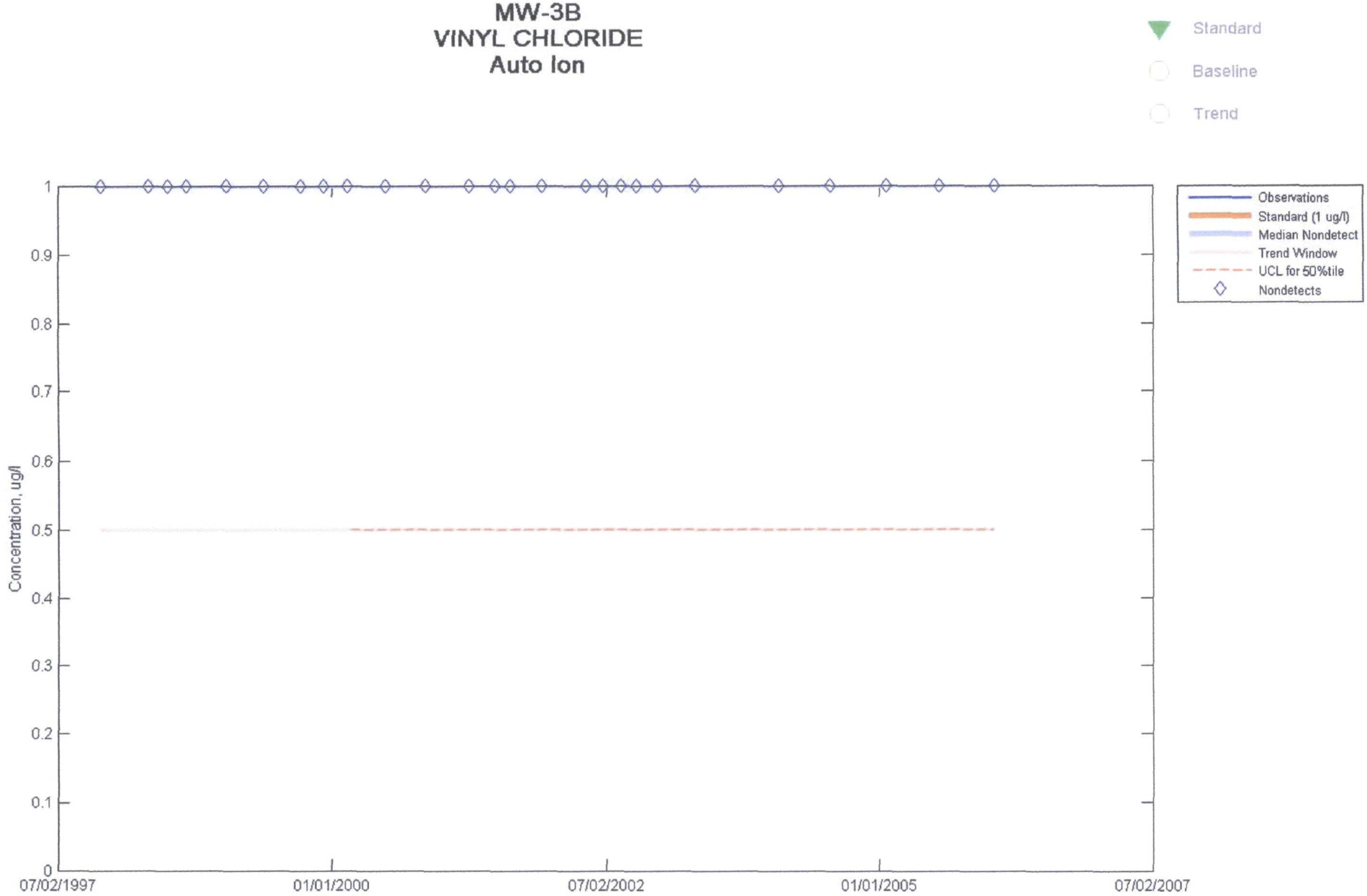


Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-3B
VINYL CHLORIDE
Auto Ion

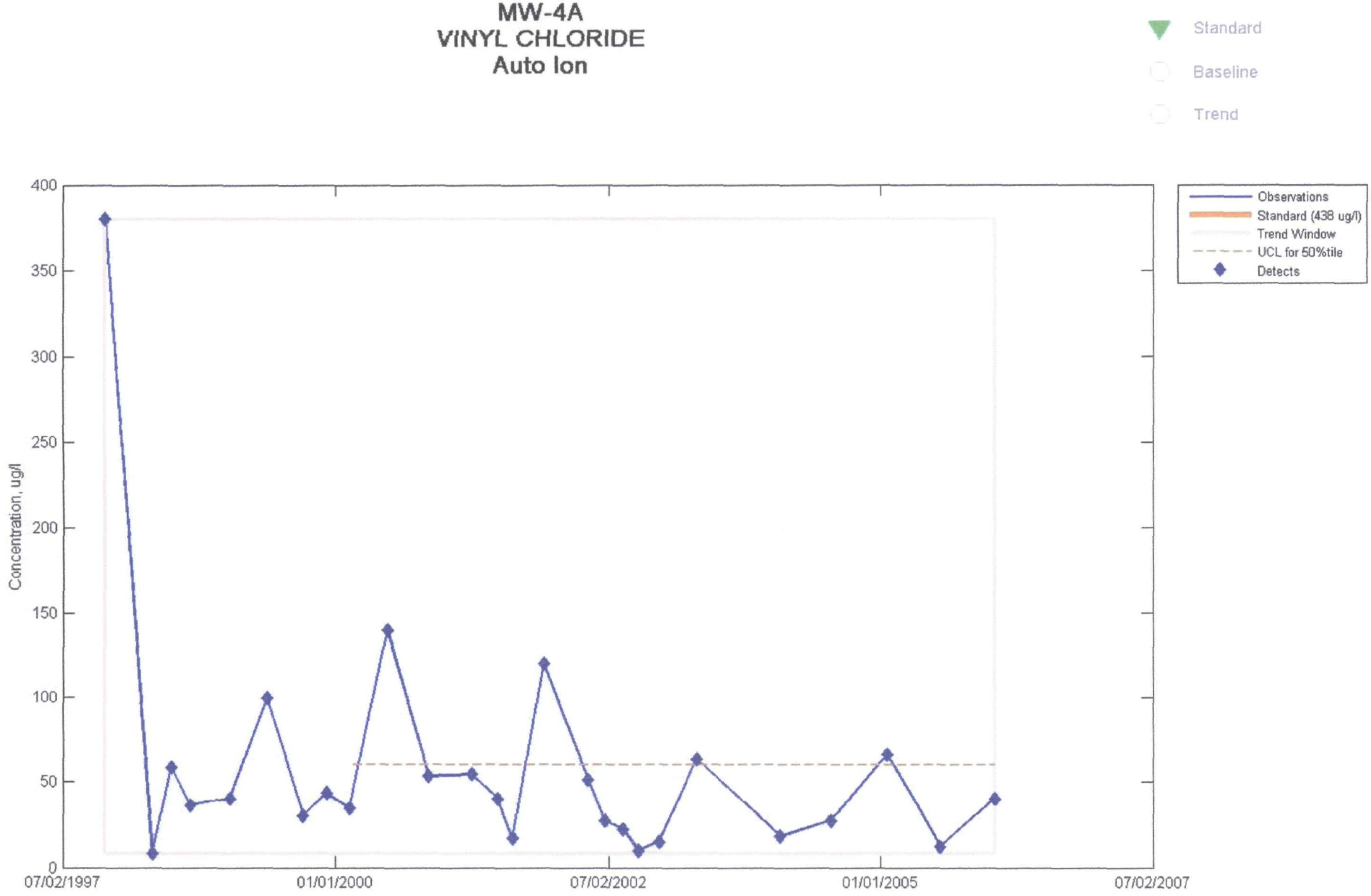


Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

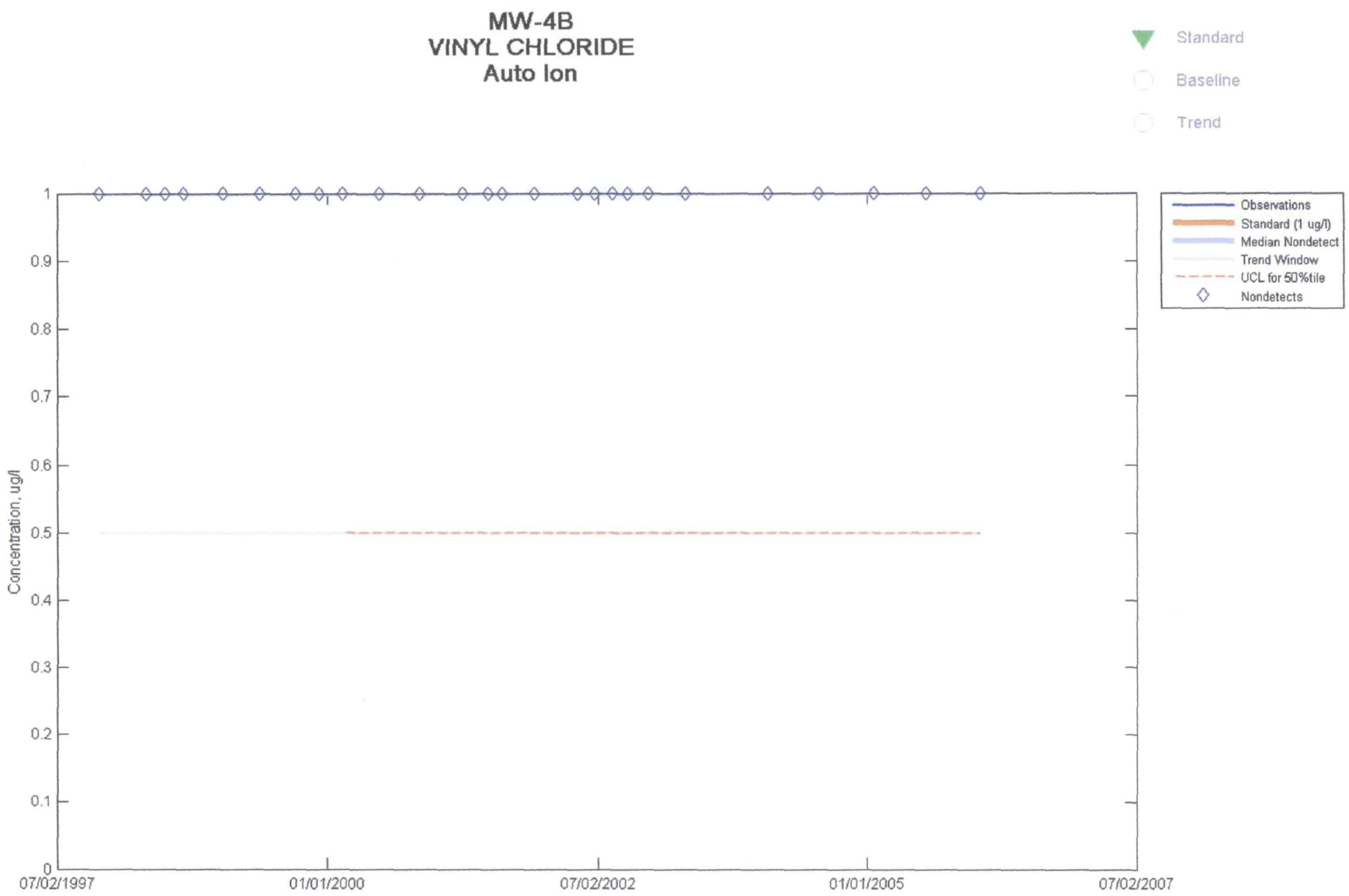
MW-4A
VINYL CHLORIDE
Auto Ion



Standard Test (95%): Compliance <UCL = 5.96e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = -3.79e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA



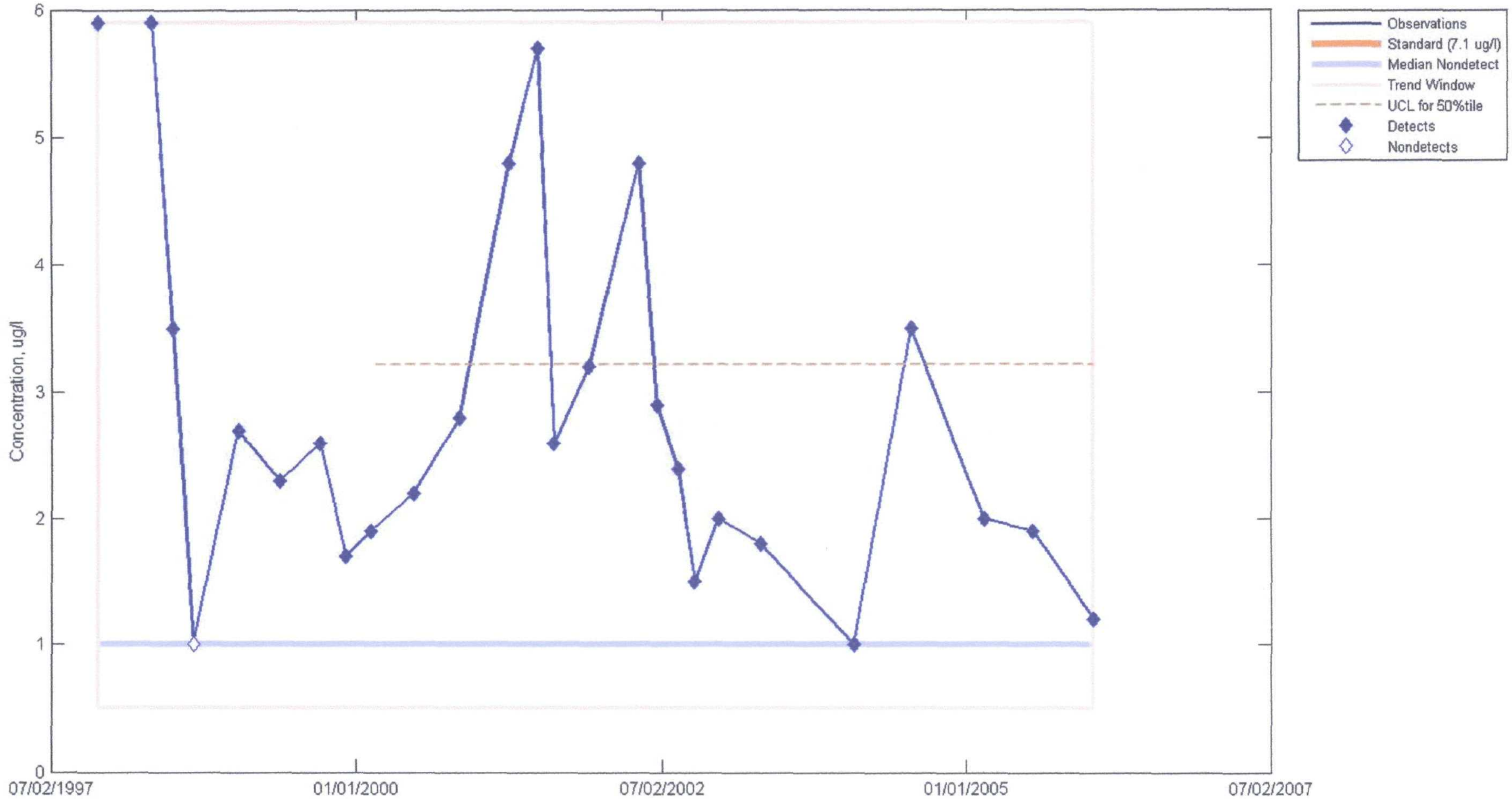
Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-5A
VINYL CHLORIDE
Auto Ion

Standard
Baseline
Trend



Standard Test (95%): Compliance <UCL = 3.21e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -2.21e-001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

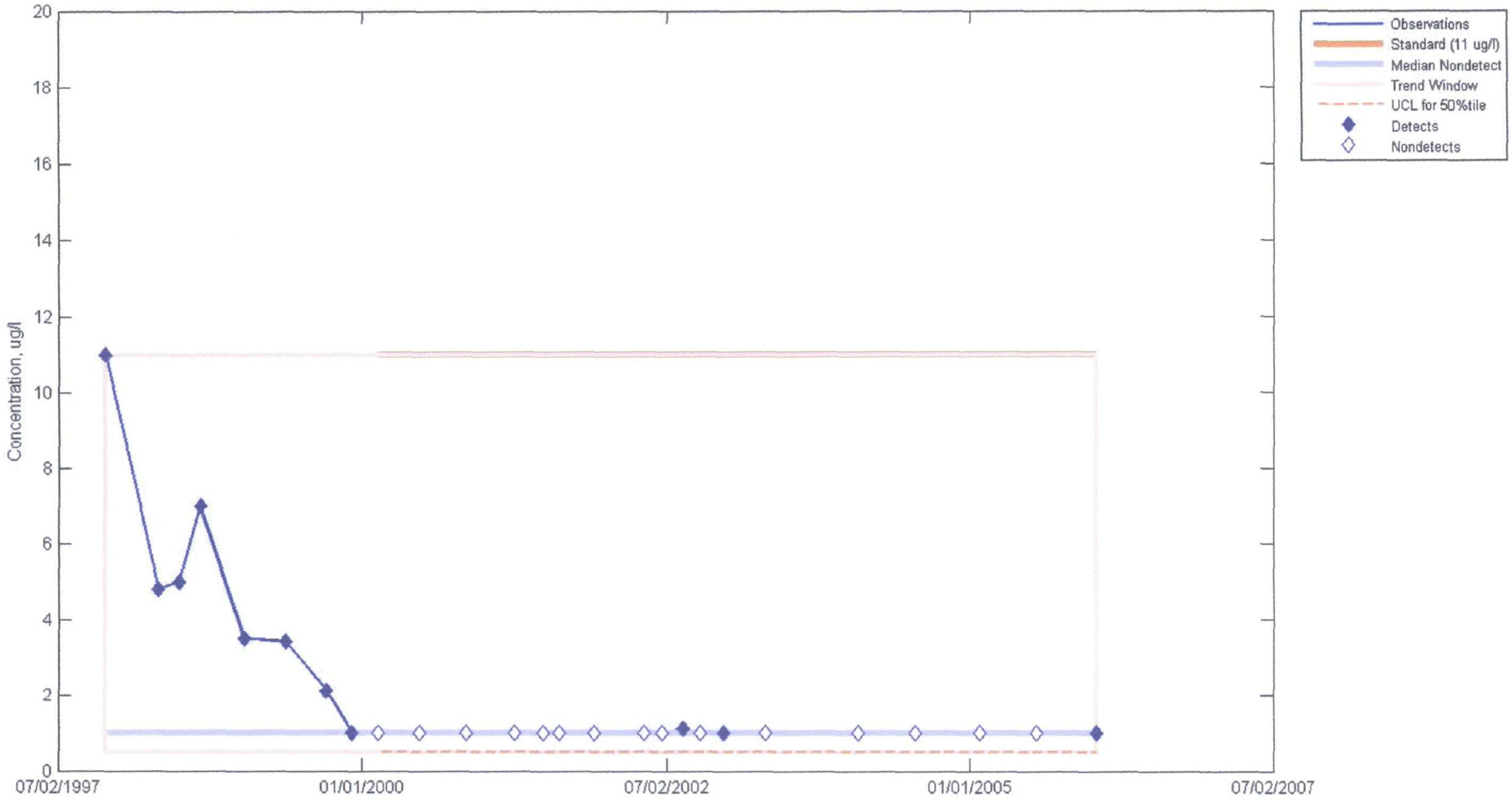
Run Date: 13-Jun-2006
Prepared by: USEPA

MW-5B
VINYL CHLORIDE
Auto Ion

Standard

Baseline

Trend

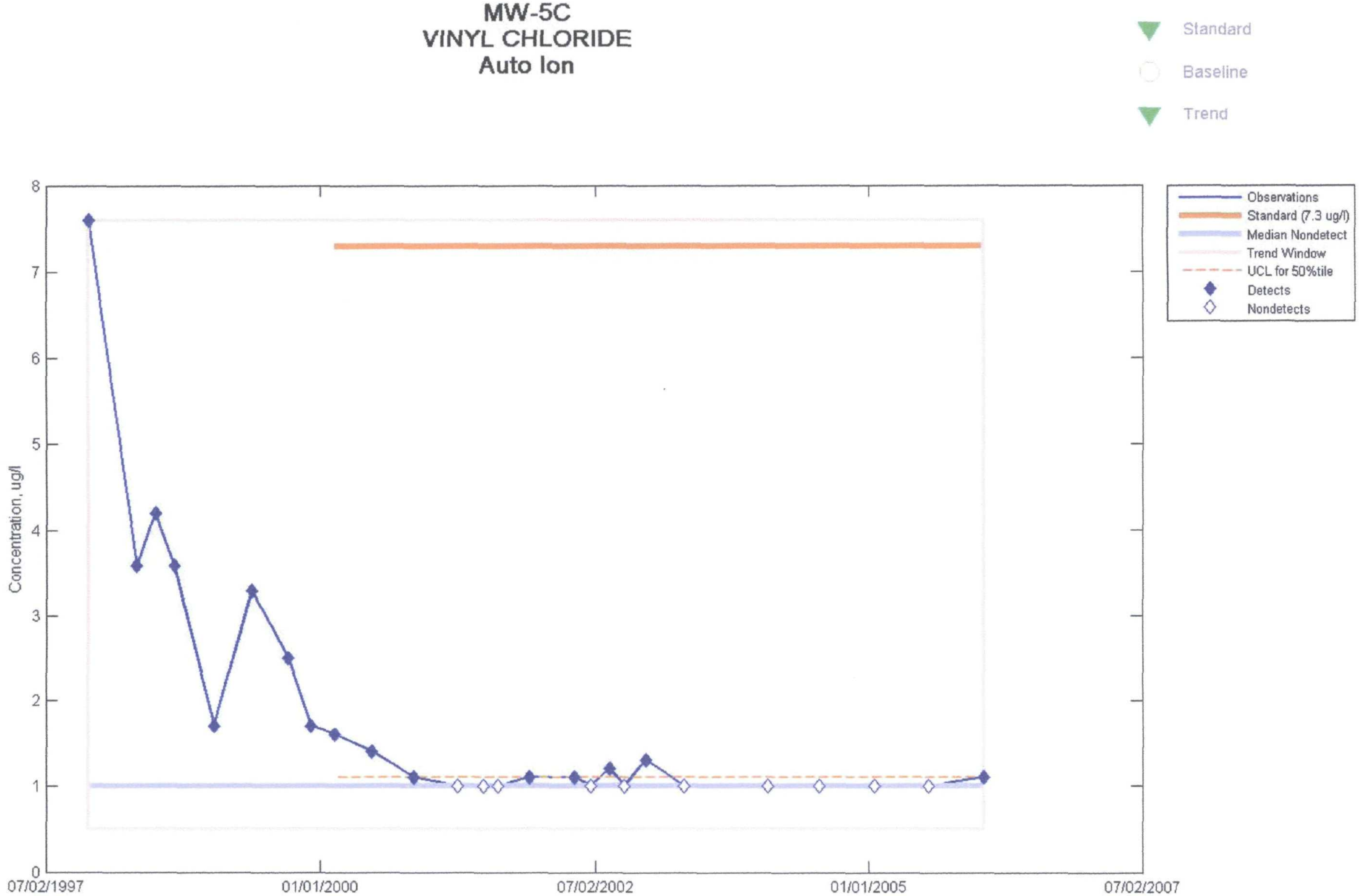


Standard Test (95%): Compliance <UCL = 5.00e-001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = -2.92e-001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

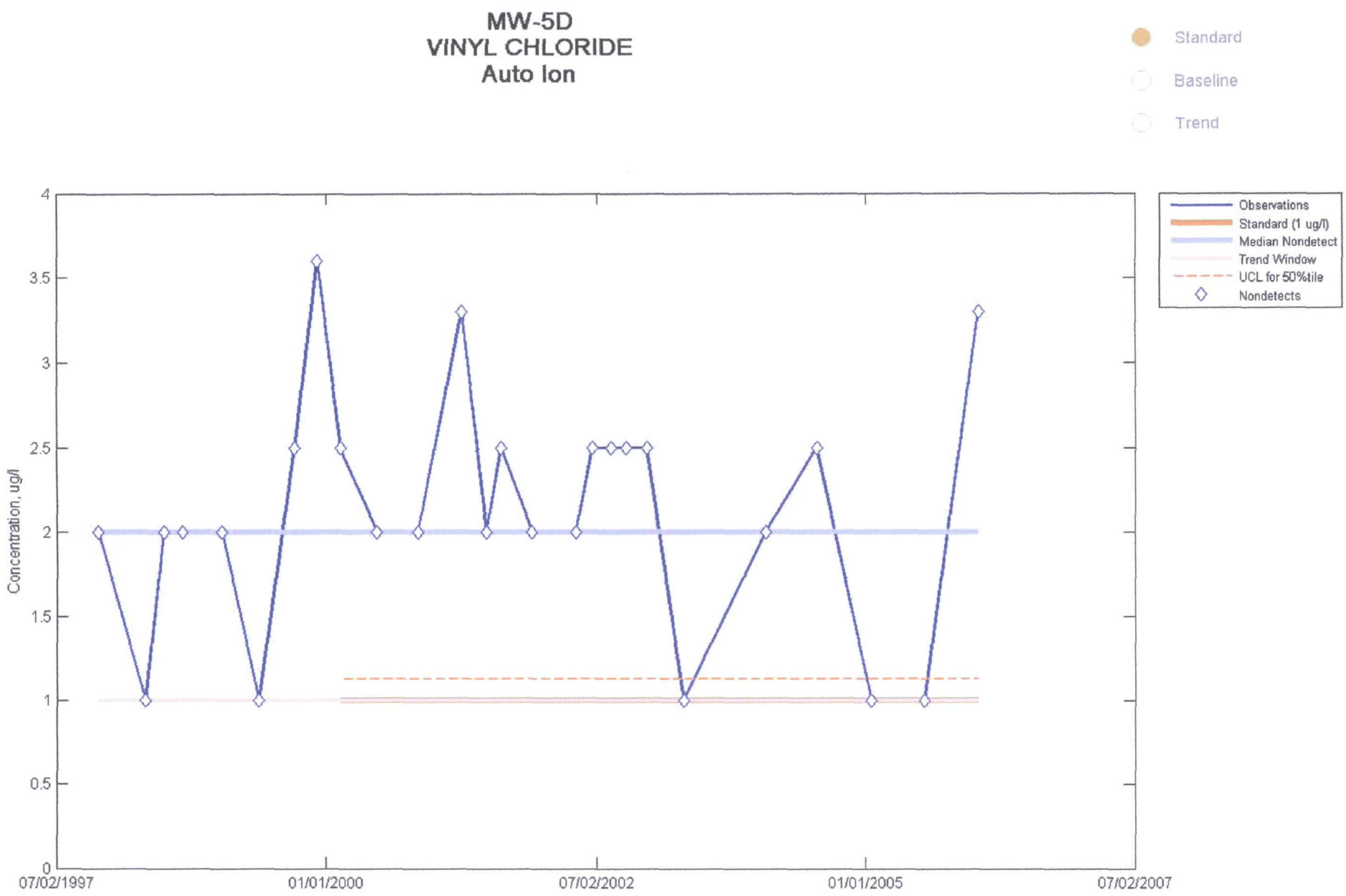
MW-5C
VINYL CHLORIDE
Auto Ion



Standard Test (95%): Compliance <UCL = 1.10e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -3.82e-001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

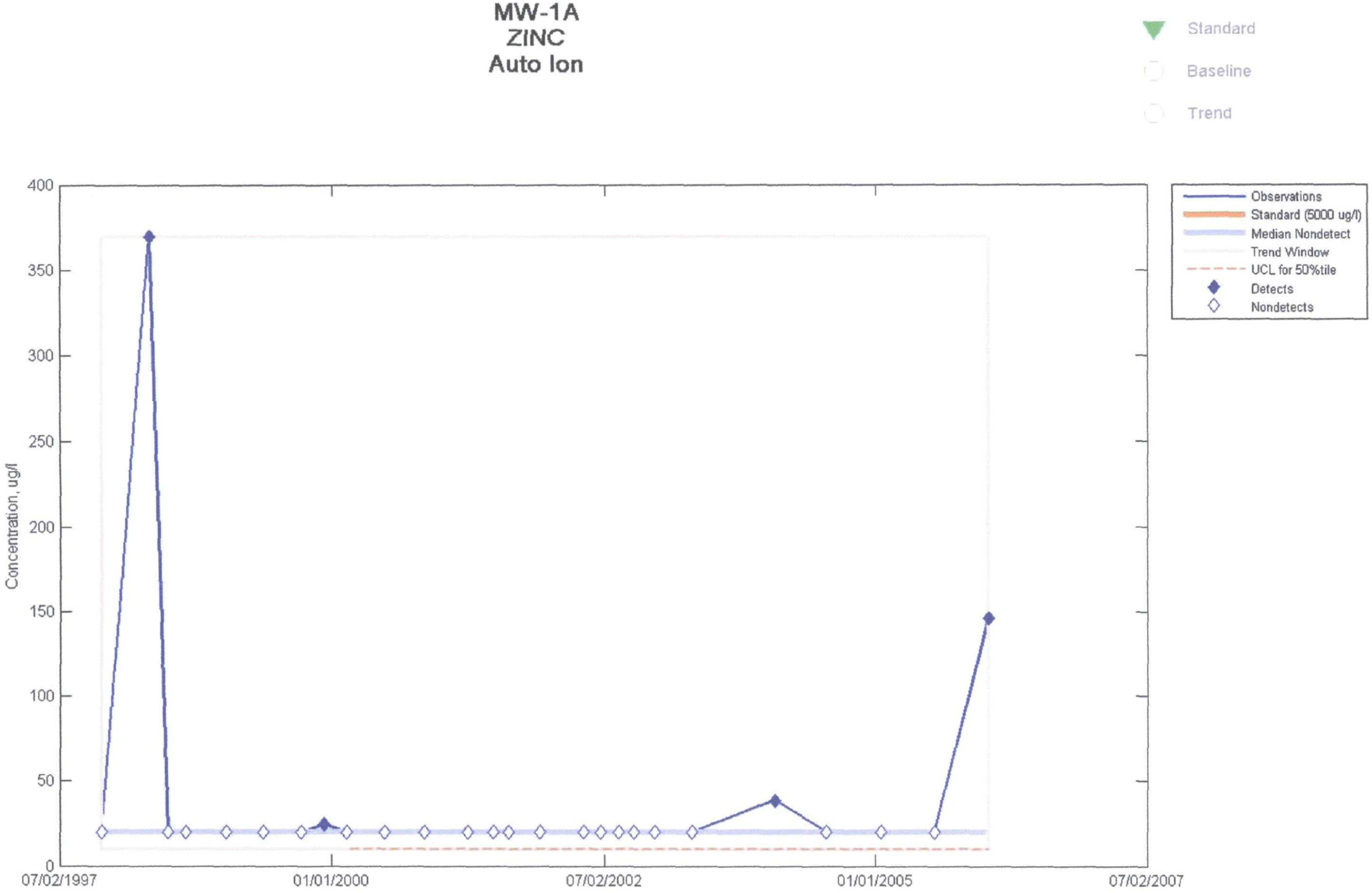


Standard Test (95%): None <UCL = 1.13e+000 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-1A
ZINC
Auto Ion

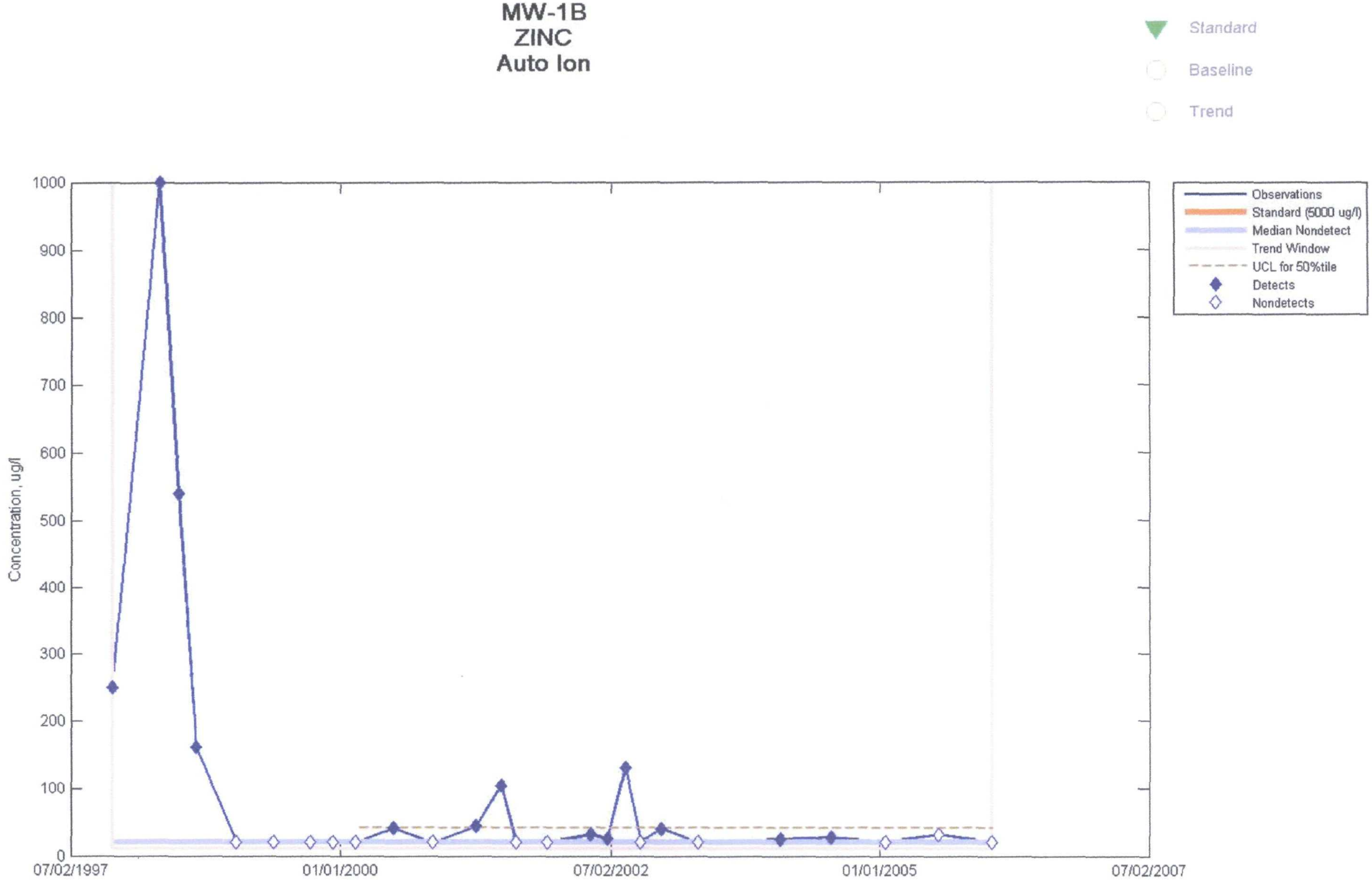


Standard Test (95%): Compliance <UCL = 1.00e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-1B
ZINC
Auto Ion

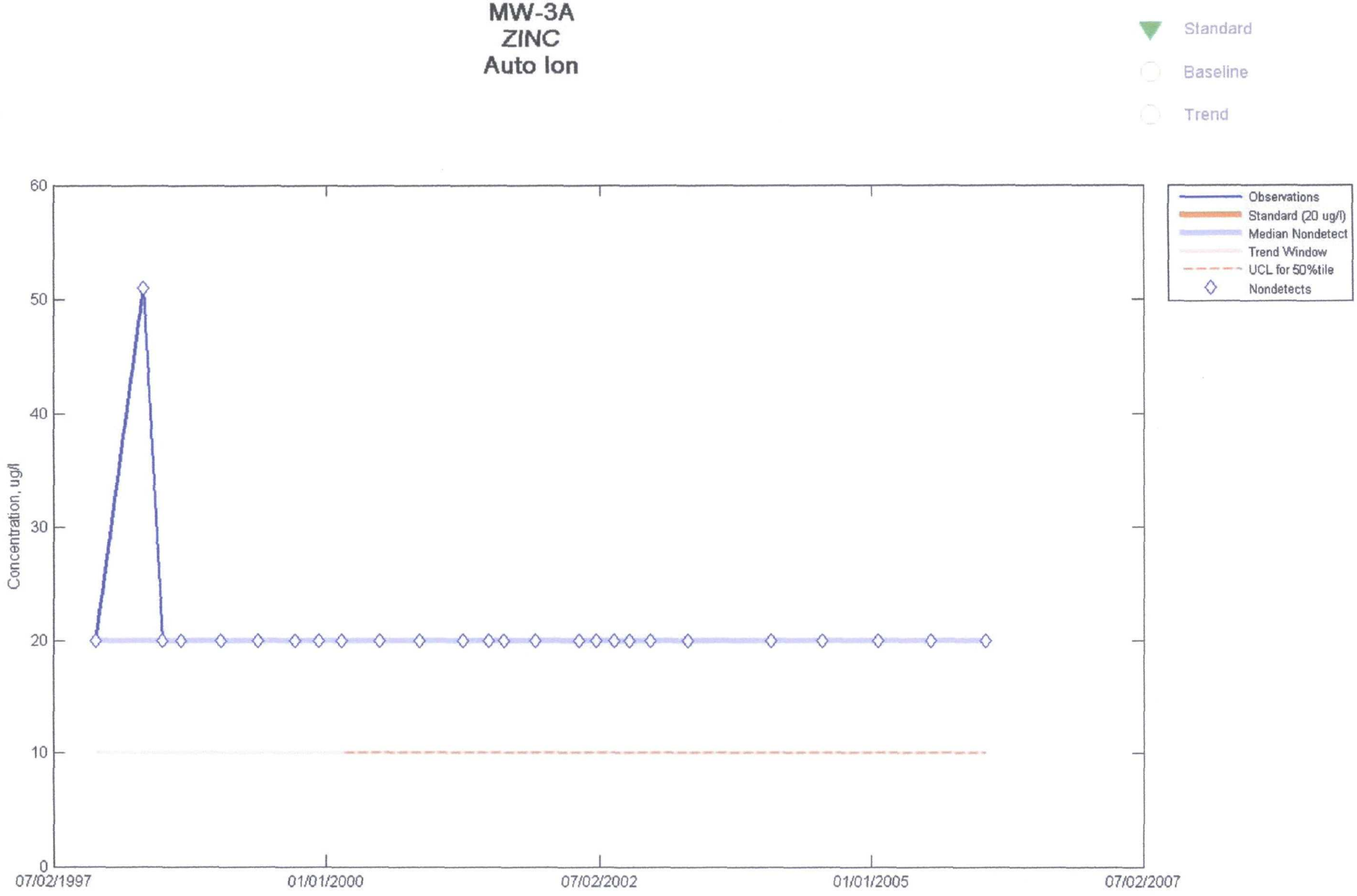


Standard Test (95%): Compliance <UCL = 4.13e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = -2.42e-001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-3A
ZINC
Auto Ion

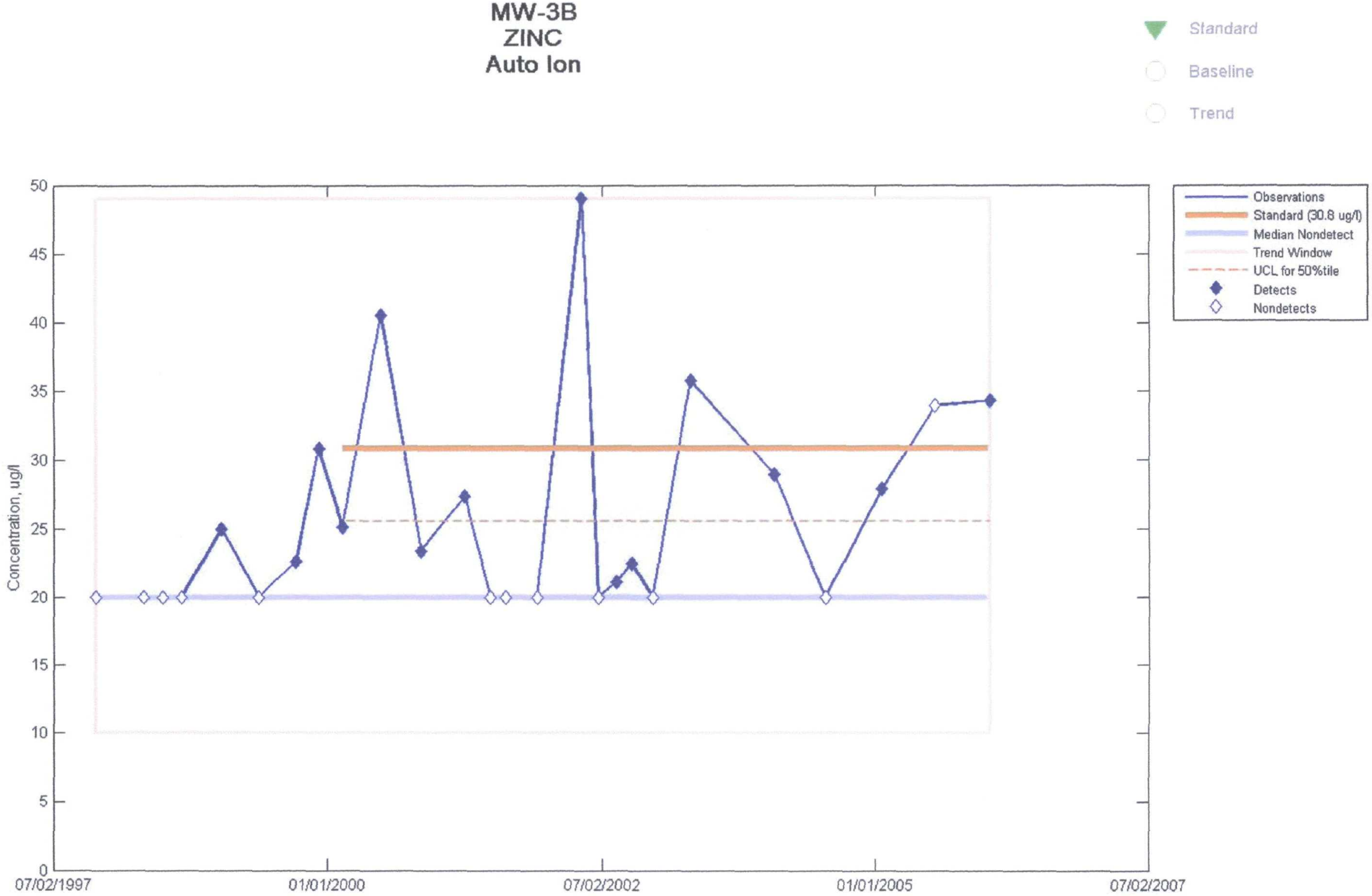


Standard Test (95%): Compliance <UCL = 1.00e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-3B
ZINC
Auto Ion



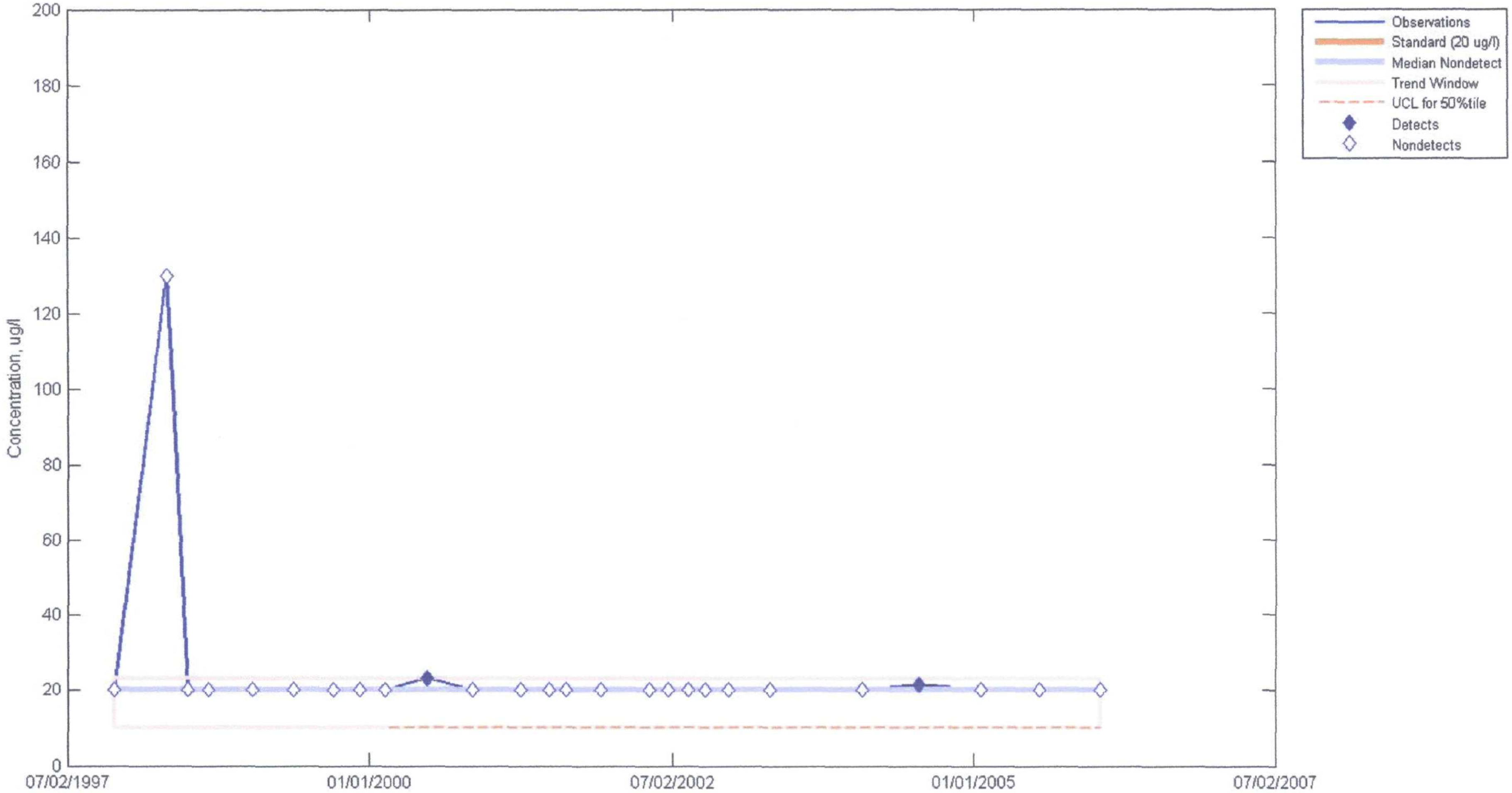
Standard Test (95%): Compliance <UCL = 2.55e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-4A
ZINC
Auto Ion

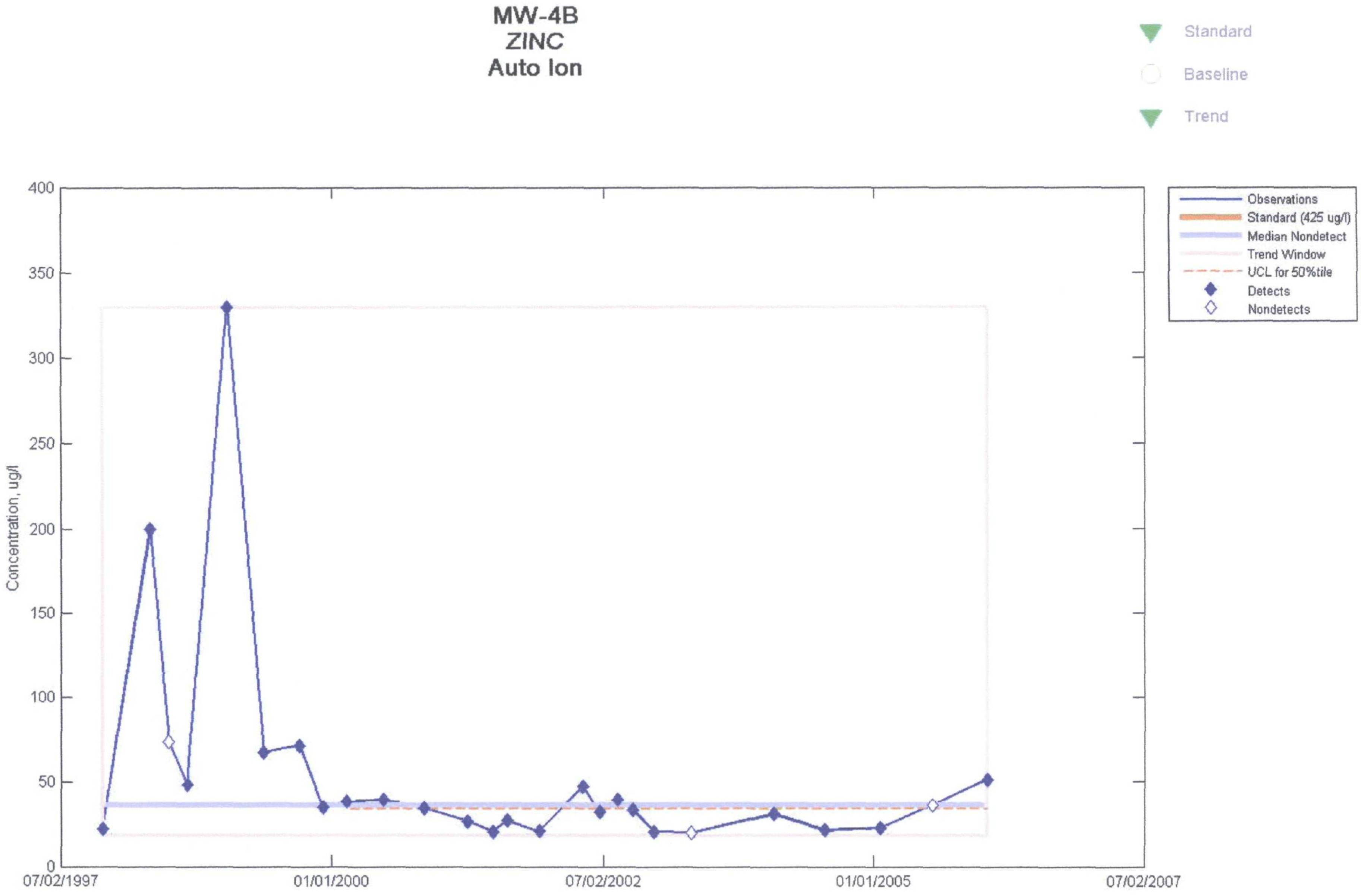
Standard
Baseline
Trend



Standard Test (95%): Compliance <UCL = 1.00e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: *ND surrogate = 0.5 X Median of nondetects' PQLs*

Run Date: 13-Jun-2006
Prepared by: USEPA

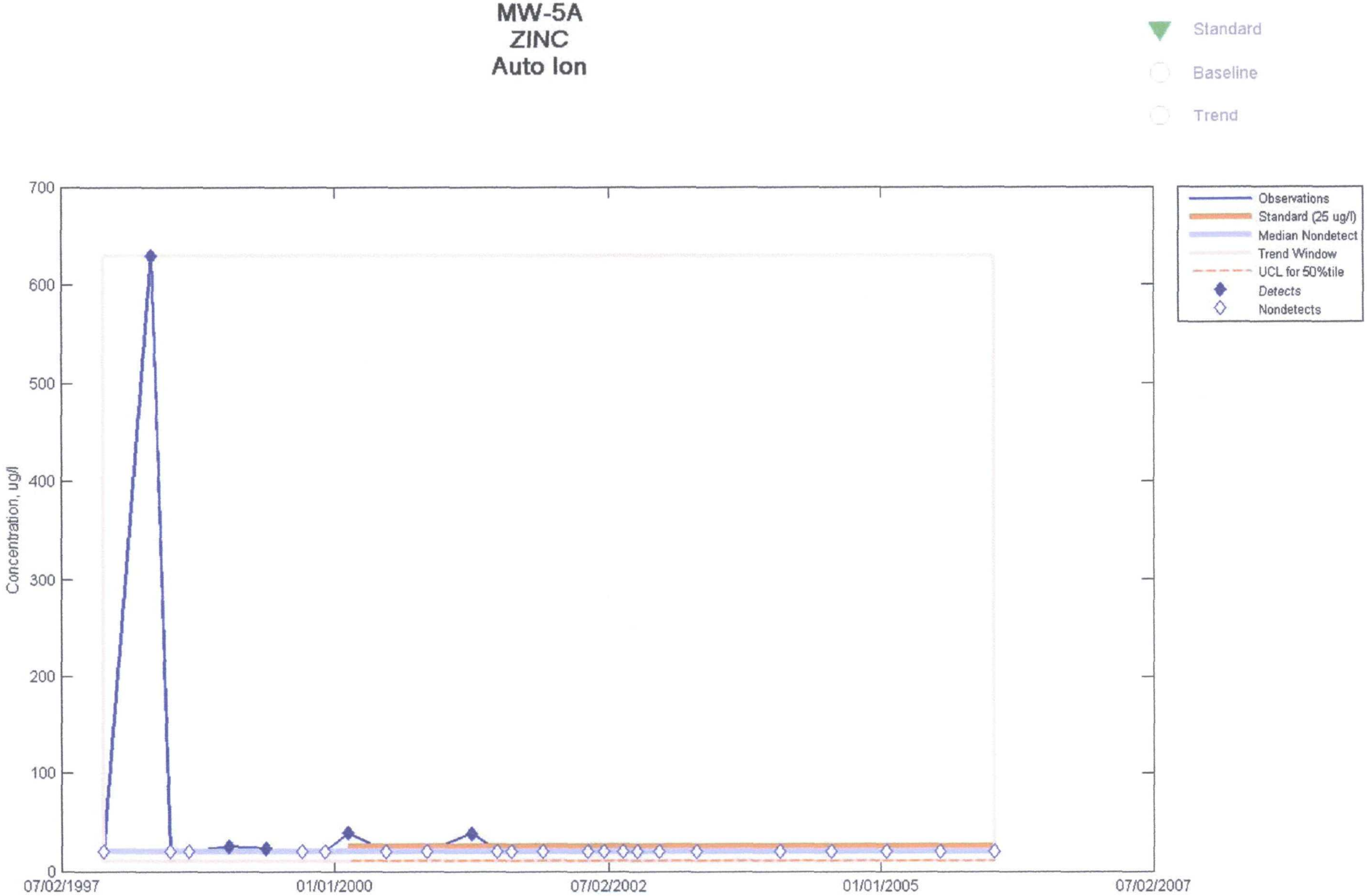


Standard Test (95%): Compliance <UCL = 3.36e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -3.63e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

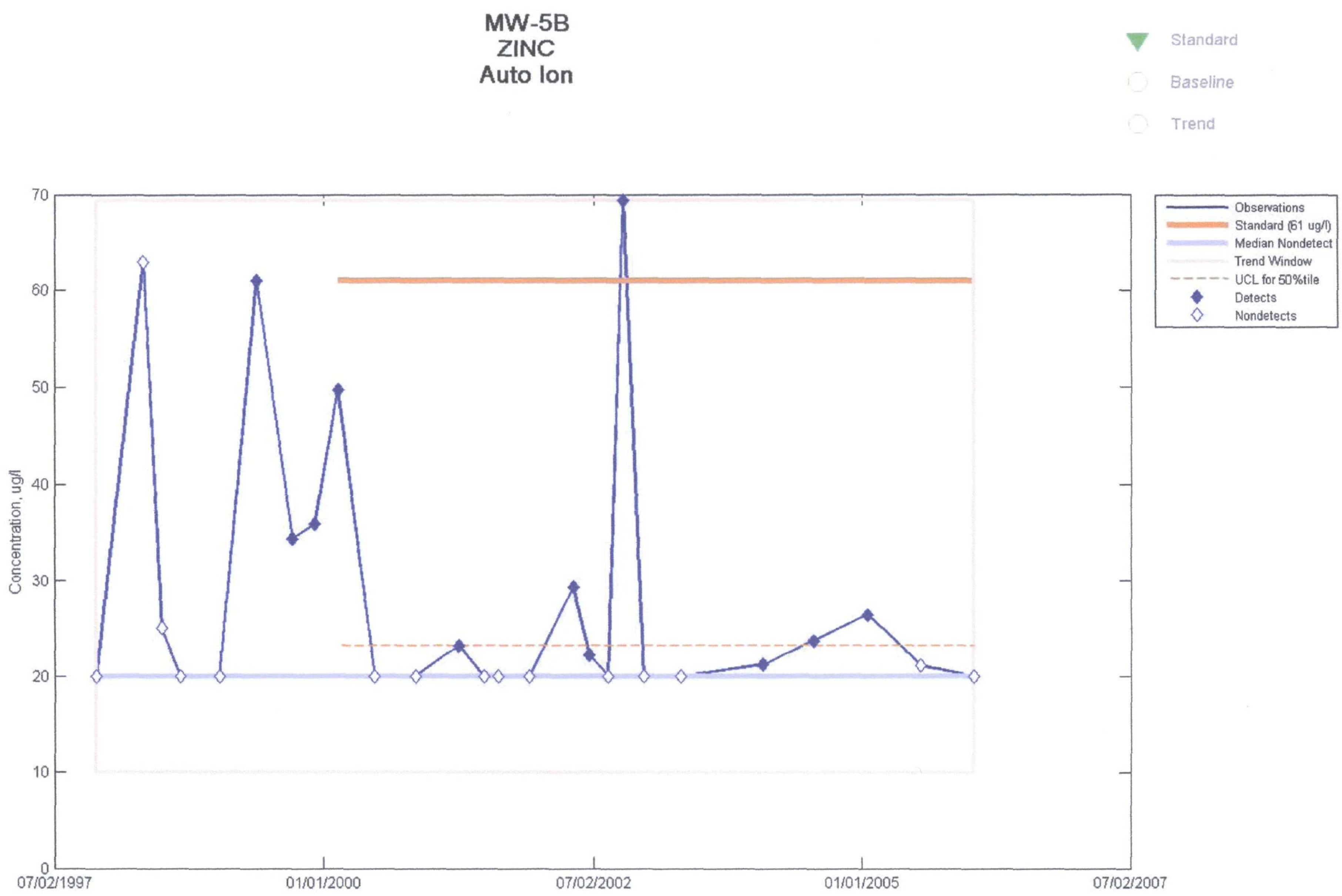
MW-5A
ZINC
Auto Ion



Standard Test (95%): Compliance <UCL = 1.00e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

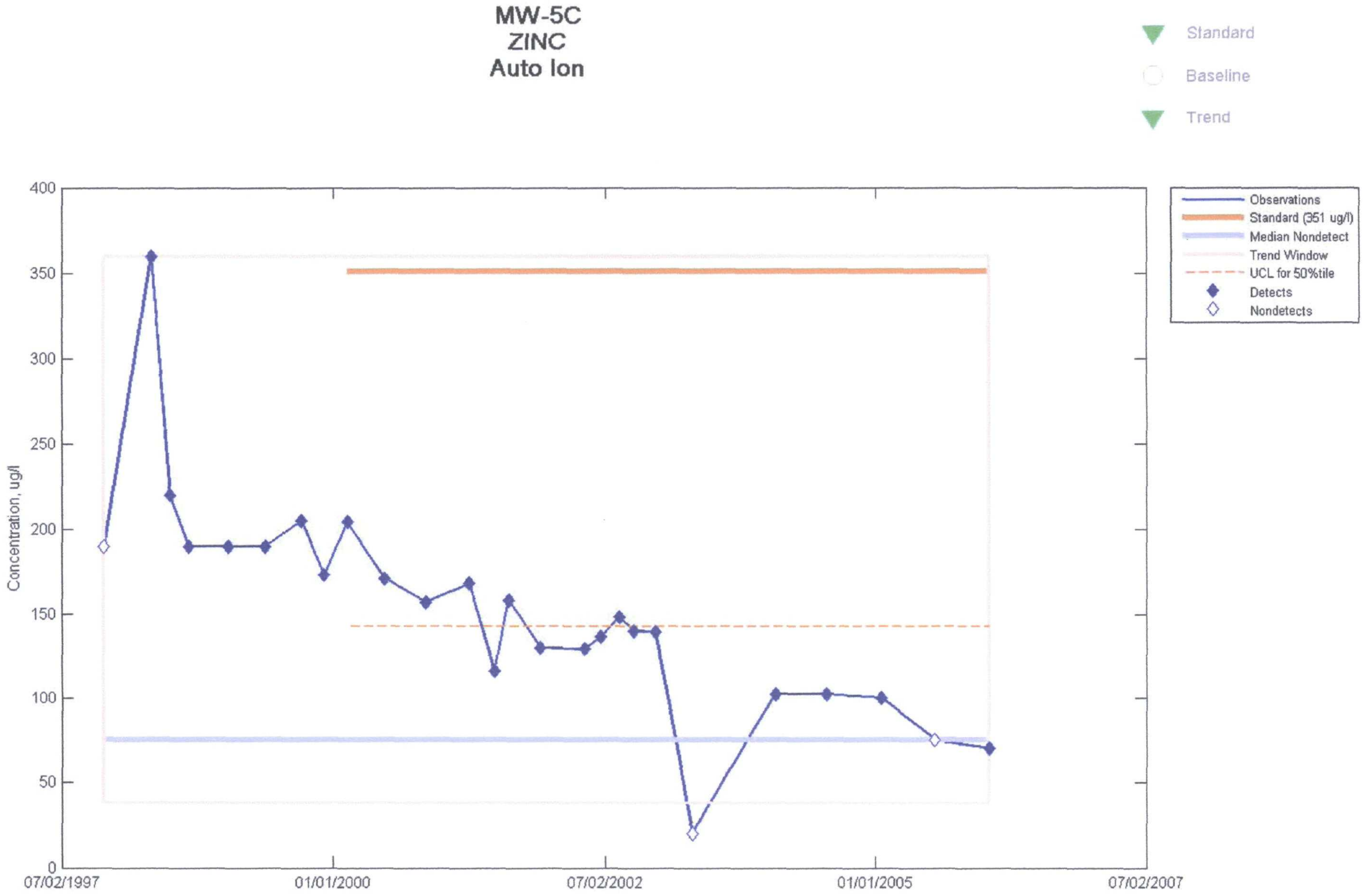
Run Date: 13-Jun-2006
Prepared by: USEPA



Standard Test (95%): Compliance <UCL = 2.32e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

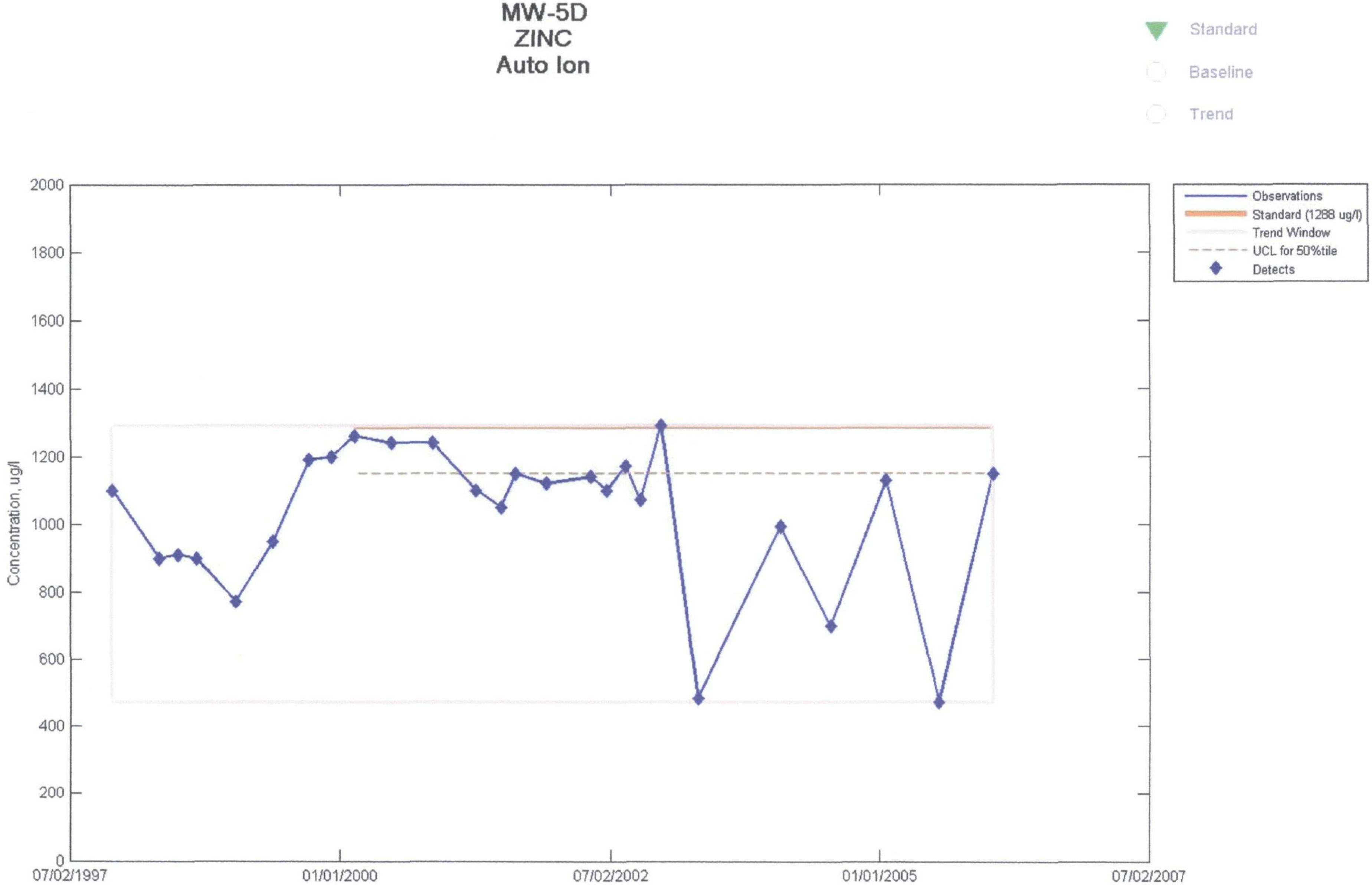


Standard Test (95%): Compliance <UCL = 1.43e+002 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Downward <Slope = -1.85e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

MW-5D
ZINC
Auto Ion



Standard Test (95%): Compliance <UCL = 1.15e+003 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = 0.00e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

ATTACHMENT 19

TABLE 1

SUMMARY OF DETECTIONS ABOVE PRELIMINARY[1] OR FINAL[2] ACLs
ROUNDS 9 THROUGH 26 CONFIRMATIONAL
AUTO ION SITE
KALAMAZOO, MICHIGAN

	Round 9	*Round 10*	*Round 11*	*Round 12*	*Round 13*	*Round 14*	*Round 15*	*Round 16*	*Round 17*	*Round 18*	*Round 19*
MW-3a		B2EP								mercury	cyanide
MW-3b	chromium	chromium		B2EP chromium				chromium cyanide	chromium		
MW-4a								cyanide			
MW-4b			nickel					chromium	chromium	chromium	chromium
MW-5a							mercury				
MW-5b						chromium	cyanide	cyanide	cyanide	cyanide	cyanide
MW-5c		chromium	chromium	B2EP chromium		chromium	chromium mercury	chromium cyanide	chromium	chromium	chromium
MW-5d								cyanide			
Detections >ACLs in Round	1	3	2	4	0	2	4	8	4	4	4
Detections Confirmed	0	1	1	0	0	0	1	1	3	1	2
Confirmed Detections Attributable to Background	0	1	1	0	0	0	0	1	2	1	1
Confirmed Detections Not Attributable to Background	0	0	0	0	0	0	1	0	1	0	1

TABLE 1

SUMMARY OF DETECTIONS ABOVE PRELIMINARY[1] OR FINAL[2] ACLs
ROUNDS 9 THROUGH 26 CONFIRMATIONAL
AUTO ION SITE
KALAMAZOO, MICHIGAN

	Round 20	*Round 21*	*Round 21 Confirmational*	*Round 22*	*Round 22 Confirmational*	*Round 23*	*Round 23 Confirmational*
MW-3a							
MW-3b		chromium		chromium		chromium mercury	
MW-4a		mercury					
MW-4b	nickel			nickel		chromium mercury nickel	mercury
MW-5a		mercury					
MW-5b	cyanide	cyanide mercury		chromium cyanide		chromium cyanide	
MW-5c	chromium	chromium nickel		chromium mercury		chromium mercury	
MW-5d				mercury		chromium mercury	
Detections >ACLs in Round	3	7	0	7	0	11	1
Detections Confirmed	1	1	0	2	0	3	1
Confirmed Detections Attributable to Background	0	0	0	1	0	1	1
Confirmed Detections Not Attributable to Background	1	1	0	1	0	2	0

TABLE 1

SUMMARY OF DETECTIONS ABOVE PRELIMINARY[1] OR FINAL[2] ACLs
ROUNDS 9 THROUGH 26 CONFIRMATIONAL
AUTO ION SITE
KALAMAZOO, MICHIGAN

	Round 24	*Round 25*	*Round 25 Confirmational*	*Round 26*	*Round 26 Confirmational*	*Totals*
MW-3a						
MW-3b	chromium	chromium zinc		chromium zinc		
MW-4a						
MW-4b	nickel	chromium mercury nickel	mercury	nickel		
MW-5a						
MW-5b	cyanide	arsenic cyanide		cyanide		
MW-5c	chromium	chromium mercury nickel	mercury	chromium mercury		
MW-5d	arsenic chromium	chromium mercury		arsenic chromium TCE		
Detections >ACLs in Round	6	12	2	9		94
Detections Confirmed	5	0	2	3		28
Confirmed Detections Attributable to Background	2	0	2	2		16
Confirmed Detections Not Attributable to Background	3	0	0	1		12

Note:

Confirmed detection greater than ACL
chromium Single underline denotes a confirmed detection attributable to background
chromium Double underline denotes a confirmed detection not attributable to background
[1]Data from Rounds 9 through 23 confirmational were compared to proposed preliminary ACLs.
[2]Data from Round 24 through 26 confirmational were compared to final ACLs.

ATTACHMENT 20

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

I. SITE INFORMATION

Site name: Auto Ion	**Date of inspection:** 6/28/06
Location and Region: Kalamazoo, MI	**EPA ID:**
Agency, office, or company leading the five-year review: U.S. EPA	**Weather/temperature:** 75°, cloudy

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other
- ☒ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Joe Branch — Geologist, CRA — 6/28/06
   Name / Title / Date
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. ______
   Problems, suggestions; ☐ Report attached ______

2. **O&M staff** ______ ______ ______
   Name / Title / Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ______
   Problems, suggestions; ☐ Report attached ______

Present at inspection:
Mary Schafer, MDEQ
Joe Branch, CRA
Mary Tierney, USEPA

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________
Contact ______________ ______________ ________ ________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______________

Agency ______________
Contact ______________ ______________ ________ ________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______________

Agency ______________
Contact ______________ ______________ ________ ________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______________

Agency ______________
Contact ______________ ______________ ________ ________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______________

4. **Other interviews** (optional) ☐ Report attached.

Joe Branch: suggests change from bladder pumps to peristaltic pumps; advantages would be — less time, less equipment, better control of flow rate; easier to achieve low flow rate; do not need to bring air compressors or air tank; decon is much more straight forward; doesn't create as much turbidity; dedicated bladder pumps would be an improvement but would be cost prohibitive and would raise concerns about vandalism; disadvantages — concerns about affecting VOC concentrations and collecting samples from deep wells may be difficult (would have to use bladder pumps for these

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☒ Readily available	☐ Up to date	☐ N/A

Remarks ______________

2.	**Site-Specific Health and Safety Plan**	☒ Readily available	☒ Up to date	☐ N/A
	☐ Contingency plan/emergency response plan	☒ Readily available	☒ Up to date	☐ N/A
	Remarks			
3.	**O&M and OSHA Training Records**	☒ Readily available	☒ Up to date	☐ N/A
	Remarks (at office)			
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
	☐ Other permits	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
7.	**Groundwater Monitoring Records**	☒ Readily available	☐ Up to date	☐ N/A
	Remarks (office)			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
10.	**Daily Access/Security Logs**	☐ Readily available	☒ Up to date	☐ N/A
	Remarks Security/access reviewed during each quarterly sampling event.			

IV. O&M COSTS

1.	**O&M Organization**	
	☐ State in-house	☐ Contractor for State
	☐ PRP in-house	☒ Contractor for PRP
	☐ Federal Facility in-house	☐ Contractor for Federal Facility
	☐ Other	

2. **O&M Cost Records**
☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate__________________ ☐ Breakdown attached

Total annual cost by year for review period if available

From__________ Date	To__________ Date	__________ Total cost	☐ Breakdown attached
From__________ Date	To__________ Date	__________ Total cost	☐ Breakdown attached
From__________ Date	To__________ Date	__________ Total cost	☐ Breakdown attached
From__________ Date	To__________ Date	__________ Total cost	☐ Breakdown attached
From__________ Date	To__________ Date	__________ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: ______________________________

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
Remarks No damage

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks Sign on east fence

C. Institutional Controls (ICs)

1.	**Implementation and enforcement** Site conditions imply ICs not properly implemented Site conditions imply ICs not being fully enforced Type of monitoring (*e.g.*, self-reporting, drive by) ________ Frequency ________ Responsible party/agency ________ Contact ________ Name ________ Title ________ Date ________ Phone no. Reporting is up-to-date Reports are verified by the lead agency Specific requirements in deed or decision documents have been met Violations have been reported Other problems or suggestions: ☐ Report attached	☐ Yes ☐ No ☐ N/A ☐ Yes ☐ No ☐ N/A ☐ Yes ☐ No ☐ N/A ☐ Yes ☐ No ☐ N/A ☐ Yes ☐ No ☐ N/A ☐ Yes ☐ No ☐ N/A	
2.	**Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A Remarks ICs have not been implemented		
D. General			
1.	**Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident Remarks________		
2.	**Land use changes on site** ☒ N/A Remarks________		
3.	**Land use changes off site** ☒ N/A Remarks________		
VI. GENERAL SITE CONDITIONS			
A. Roads ☐ Applicable ☐ N/A			
1.	**Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks________		
B. Other Site Conditions			

Remarks None.

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent______ **Depth**______
   Remarks______

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths______ **Widths**______ **Depths**______
   Remarks______

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent______ **Depth**______
   Remarks______

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent______ **Depth**______
   Remarks______

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks______

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks______

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent______ Height______
   Remarks______

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent______
   ☐ Ponding ☐ Location shown on site map Areal extent______
   ☐ Seeps ☐ Location shown on site map Areal extent______
   ☐ Soft subgrade ☐ Location shown on site map Areal extent______
   Remarks______

9.	**Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability Areal extent______________ Remarks______________	
B. Benches	☐ Applicable ☐ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)	
1.	**Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay Remarks______________	
2.	**Bench Breached** ☐ Location shown on site map ☐ N/A or okay Remarks______________	
3.	**Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay Remarks______________	
C. Letdown Channels	☐ Applicable ☐ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)	
1.	**Settlement** ☐ Location shown on site map ☐ No evidence of settlement Areal extent______________ Depth______________ Remarks______________	
2.	**Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation Material type______________ Areal extent______________ Remarks______________	
3.	**Erosion** ☐ Location shown on site map ☐ No evidence of erosion Areal extent______________ Depth______________ Remarks______________	
4.	**Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting Areal extent______________ Depth______________ Remarks______________	
5.	**Obstructions** Type______________ ☐ No obstructions ☐ Location shown on site map Areal extent______________ *Size*______________ Remarks______________	

6. **Excessive Vegetative Growth** Type________________

☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent______________
Remarks____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks____

2. **Gas Monitoring Probes**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____

3. **Monitoring Wells** (within surface area of landfill)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____

4. **Leachate Extraction Wells**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks____

2. **Gas Collection Wells, Manifolds and Piping**

☐ Good condition ☐ Needs Maintenance
Remarks____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A
Remarks____

F. Cover Drainage Layer	☐ Applicable	☐ N/A	
1. **Outlet Pipes Inspected** Remarks______________________________	☐ Functioning	☐ N/A	
2. **Outlet Rock Inspected** Remarks______________________________	☐ Functioning	☐ N/A	
G. Detention/Sedimentation Ponds	☐ Applicable	☐ N/A	
1. **Siltation** Areal extent__________ Depth__________ ☐ Siltation not evident Remarks______________________________			☐ N/A
2. **Erosion** Areal extent__________ Depth__________ ☐ Erosion not evident Remarks______________________________			
3. **Outlet Works** Remarks______________________________	☐ Functioning	☐ N/A	
4. **Dam** Remarks______________________________	☐ Functioning	☒ N/A	
H. Retaining Walls	☐ Applicable	☐ N/A	
1. **Deformations** Horizontal displacement__________ Vertical displacement__________ Rotational displacement__________ Remarks______________________________	☐ Location shown on site map	☐ Deformation not evident	
2. **Degradation** Remarks______________________________	☐ Location shown on site map	☐ Degradation not evident	
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable	☐ N/A	
1. **Siltation** Areal extent__________ Depth__________ Remarks______________________________	☐ Location shown on site map	☐ Siltation not evident	
2. **Vegetative Growth** ☐ Vegetation does not impede flow Areal extent__________ Type__________ Remarks______________________________	☐ Location shown on site map	☐ N/A	

3.	**Erosion** ☐ Location shown on site map ☐ Erosion not evident Areal extent______________ Depth____________ Remarks____
4.	**Discharge Structure** ☐ Functioning ☐ N/A Remarks____
	VIII. VERTICAL BARRIER WALLS ☐ Applicable ☐ N/A
1.	**Settlement** ☐ Location shown on site map ☐ Settlement not evident Areal extent______________ Depth____________ Remarks____
2.	**Performance Monitoring** Type of monitoring______________________ ☐ Performance not monitored Frequency_______________________ ☐ Evidence of breaching Head differential_________________ Remarks____
	IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☐ N/A
	A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A
1.	**Pumps, Wellhead Plumbing, and Electrical** ☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks____
2.	**Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ Good condition ☐ Needs Maintenance Remarks____
3.	**Spare Parts and Equipment** ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks____
	B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A
1.	**Collection Structures, Pumps, and Electrical** ☐ Good condition ☐ Needs Maintenance Remarks____
2.	**Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ Good condition ☐ Needs Maintenance Remarks____

3.	**Spare Parts and Equipment** ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks
C. Treatment System	☐ Applicable ☐ N/A
1.	**Treatment Train** (Check components that apply) ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☐ Air stripping ☐ Carbon adsorbers ☐ Filters ☐ Additive (*e.g.*, chelation agent, flocculent) ☐ Others ☐ Good condition ☐ Needs Maintenance ☐ Sampling ports properly marked and functional ☐ Sampling/maintenance log displayed and up to date ☐ Equipment properly identified ☐ Quantity of groundwater treated annually ☐ Quantity of surface water treated annually Remarks
2.	* **Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks
3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance Remarks
4.	**Discharge Structure and Appurtenances** ☐ N/A ☐ Good condition ☐ Needs Maintenance Remarks
5.	**Treatment Building(s)** ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks
6.	**Monitoring Wells** (pump and treatment remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks See attached table
D. Monitoring Data	
1.	Monitoring Data ☒ Is routinely submitted on time ☐ Is of acceptable quality
2.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

* Installed for purposes of running transducers to measure water levels. Not used at this time.

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks See attached table

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

"Non-live" electrical wire hanging from abandoned utility pole

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	**Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

See pg 2.

AUTO ION SITE
June 28, 2006

	Secured/Locked	Routinely Sampled	Condition	Needs Maintenance	Comments
MW-1B	Flush mount; screw top, but screws were stripped	Yes	Good	Cap inside flush mount cover was not locked/sealed → New lock installed - OKAY	New cap put on and locked; ponded water within cover
MW-1A	Flush mount; screw cover; inner lock not working	Yes	Good	New cap installed and locked OKAY	Ponded water inside cover
MW-3A	Flush cap; inner cap was popped	Yes	Good	OKAY	—
MW-3B	Flush cap	Yes	Good	OKAY	Ponded water inside cover
MW-4B	Flush mount; cap was popped	Yes	Poor(?)	Cave-in/subsidence within cover; may need maintenance	Top of well casing is lower than it should be → because it's deep, may not compromise the samples
MW-4A	Flush mount; cap was popped	Yes	OKAY	Needs bolts for cover	—
MW-5A	Flush mount; cap was popped	Yes	Good	OKAY	—
MW-5B	Flush mount	Yes	Good	Some subsidence/cave-in	—
MW-5C	Flush mount cover has settled	Yes	Good	Some subsidence May need maintenance	Cover could not be completely secured because of uneven surface
MW-5D	Flush mount	Yes	Good	Need to get new bolts	Large amount of ponded water within cover

Call power company to check on old cables

ATTACHMENT 21

AUTO ION SITE
KALAMAZOO, MICHIGAN

TABLE 2-1

SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC ARARs

REGULATION	CHEMICAL-SPECIFIC REQUIREMENTS	CITATION	POTENTIAL ARAR
Federal Safe Drinking Water Act (SDWA)	MCLs and MCLGs	40 CFR 141.11-14.16 & 141.50-141.51	No (1)
Michigan Safe Drinking Water Act (MSDWA)	MCLs and MCLGs	MI ACT 325 SEC. 325.1006	No (2)
Michigan Environmental Response Act (Act 307)	Type B Criteria and Type C Site Specific Risk Assessment	MI ACT 307 R717	Yes
Federal Resource Conservation and Recovery Act (RCRA)	MCLs or ACLs	RCRA 40 CFR Sec. 3004(p)	No (3)
Michigan Hazardous Waste Management Act (Act 64)	MCLs or ACLs	MI ACT 64 R299.4612	Yes
Federal Clean Water Act (CWA)	Water Quality Criteria	51 Federal Register 43665	No (4)
Michigan Water Resources Commission Act (WRC)	Water Quality Standards	MI ACT 245 R 323.1041-1116	Yes

(1) TBC
(2) Same as Federal SDWA Requirements
(3) Less Stringent than Michigan Act 64 Requirements
(4) Less Stringent than Michigan WQS

684031TBL2-1

AUTO ION SITE
KALAMAZOO, MICHIGAN

TABLE 2-3

POTENTIAL MICHIGAN LOCATION-SPECIFIC ARARS

REGULATED LOCATION	REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
All the waters of the Great Lakes within the boundaries of the state;	Dredging or placing spoil or other materials on bottomland of any of the Great Lakes or associated waterway within state boundaries	Great Lakes Submerged Lands Act	Act 247; Public Acts of 1955, as ammended; MCL 322.703	No
Within 61 meters of a fault which had its displacement in Holocene time;	The location of active portions of new treatment, storage or disposal facilities, or expansions enlargements, or alterations of existing facilities;	Hazardous Waste Management Act General Rules – Part 6 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;	Act 64, Public Acts of 1979, as ammended R299.9603	No
In a floodway designated by Act 245	The location of active portions of new treatment, storage, or disposal facilities, or expansions, enlarge-ments, or alterations of existing facilities;	Hazardous Waste Management Act General Rules – Part 6 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;	Act 64, Public Acts of 1979, as ammended R299.9603	Yes
In a coastal high-risk area designated under the Shorelands Protection and Management Act;	The location of active portions of new treatment, storage, or disposal facilities, or expansions, enlarge-ments, or alterations of existing facilities;	Hazardous Waste Management Act General Rules – Part 6 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;	Act 64, Public Acts of 1979, as ammended R299.9603	No
Over a sole-source aquifer or the recharge zone of a sole source aquifer	The location of active portions of new treatment, storage, or disposal facilities, or expansions, enlarge-ments, or alterations of existing facilities;	Hazardous Waste Management Act General Rules – Part 6 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;	Act 64, Public Acts of 1979, as ammended R299.9603	No

TABLE 2-3 Continued...

REGULATED LOCATION	REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
Within that isolation distance from public water supplies specified by Act 399	The location of active portions of new treatment, storage, or disposal facilities, or expansions, enlargements, or alterations of existing facilities;	Hazardous Waste Management Act General Rules - Part 6 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;	Act 64, Public Acts of 1979, as ammended R299.9603	No
In a wetland	The location of active portions of new treatment, storage, or disposal facilities, or expansions, enlargements, or alterations of existing facilities;	Hazardous Waste Management Act General Rules - Part 6 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;	Act 64, Public Acts of 1979, as ammended R299.9603	No
At least 150 meters from adjacent commercial, residential, or recreational property lines	The location of an active portion of a new landfill	Hazardous Waste Management Act General Rules - Part 6 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;	Act 64, Public Acts of 1979, as ammended R299.9603	No
At least 60 meters from adjacent commercial, residential, or recreational property lines	The location of hazardous waste treatment, storage, or disposal facilities other than landfills	Hazardous Waste Management Act General Rules - Part 6 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;	Act 64, Public Acts of 1979, as ammended R299.9603	Yes
Areas with less than 6 meters of soil with a maximum permeability greater than 1.0 e-6 cm/s at all points below and lateral to the landfill, surface impoundment or waste pile	The location of landfills, surface impoundments and waste piles	Hazardous Waste Management Act General Rules - Part 6 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities;	Act 64, Public Acts of 1979, as ammended R299.9603	No
Tunnels, process equipment, shaft or enclosed space	Entry into a tunnel, process equipment, shaft or enclosed space	Michigan Occupational Safety and Health Act Occupational Health Standards for General Industry	Act 154, Public Acts of 1974 Rule 3301	No

TABLE 2-3 Continued...

REGULATED LOCATION	REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
Confined spaces	Entry into a confined space	Michigan Occupational Safety and Health Act Construction Safety Standards	Act 154, Public Acts of 1974 R408.40120	No
Confined spaces	Entry into a confined space	Michigan Occupational Safety and Health Act General Industry Standards	Act 154, Public Acts of 1974 R408.10016	No
100 ft. from the river's edge	Prohibition or limitation of cutting trees or other vegetation	Natural River Act of 1970	Act 231, Public Acts of 1970 MCL 281.770	Yes
300 ft. from the river's edge	Prohibition or limitation of mining and drilling for oil and gas	Natural River Act of 1970	Act 231, Public Acts of 1970 MCL 281.770	No
400 ft. from the river's edge	Control the use of the lands	Natural River Act of 1970	Act 231, Public Acts of 1970 MCL 281.770	Yes
The land, water, and land beneath the water which is in close proximity to the shoreline of a Great Lake or a connecting waterway (shoreland)	Dredging, filling, grading, or other alterations of the soil; Alteration of natural drainage, but not including the reasonable care and maintenance of established drainage improvement works; Alteration of vegetation utilized by fish and wildlife, or both, for the uses covered in subrules (1) and (2) of this rules; Placement of permanent structures;	Shorelands Protection and Management Act of 1970	Act 245, Public Acts of 1970 R281.24	Yes

TABLE 2-3 Continued...

REGULATED LOCATION	REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
Any area which is within the 100 year floodplain of a Great Lake or a connecting waterway (flood risk area)	Dredging, filling, grading, or other alterations of the soil; Alteration of natural drainage, but not including the reasonable care and maintenance of established drainage improvement works; Alteration of vegetation utilized by fish and wildlife, or both, for the uses covered in subrules (1) and (2) of this rules; Placement of permanent structures;	Shorelands Protection and Management Act of 1970	Act 245, Public Acts of 1970 R281.24	Yes
Lands within 500 feet of a lake or stream of this state	The location of transportation facilities, industrial or commercial development, utilities, oil, gas, and mineral wells, water impoundments and waterway construction;	Soil Erosion and Sedimentation Control Act	Act 347, Public Acts of 1972 R323.1704	Yes
Michigan counties having a population density of less than 50 persons per square mile based on 1970 census data	The location of Type II sanitary landfills	Solid Waste Management Act	Act 641, Public Acts of 1978 R299.4307	No
Within a standard metropolitan statistical area	The location of Type II sanitary landfills	Solid Waste Management Act	Act 641, Public Acts of 1978 R299.4307	No
Within 100 feet of adjacent property lines, road rights-of-way or lakes and perennial streams	The location of Type II sanitary landfills	Solid Waste Management Act	Act 641, Public Acts of 1978 R299.4307	No
Within 300 feet of domiciles in existence at time of construction	The location of Type II sanitary landfills	Solid Waste Management Act	Act 641, Public Acts of 1978 R299.4307	No

TABLE 2-3 Continued...

REGULATED LOCATION	REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
Wetlands	Deposition or permitting the placing of fill material in a wetland; dredging, removing or permitting the removal of soil or minerals from a wetland; constructing, operating, or maintaining any use or development in a wetland; and draining surface water from a wetland;	Goemaire-Anderson Wetland Protection Act	Act 203, Public Acts of 1979 MCL 281.705	No
Within 50 feet from the shore or bank of any lake or stream	Storage of salt	Water Resources Commission Act Part 5 – Spillage of Oil and Polluting Materials	Act 245, Public Acts of 1929 R323.1157	No
Floodplains (that area of land adjoining a river or stream which will be inundated by a 100-year flood)	Occupying, filling, or grading lands in a floodplain, streambed, or channel of a stream	Water Resources Commission Act Part 13 – Floodplains and Floodways	Act 245, Public Acts of 1929 R323.1313	Yes
Floodplains (the channel of a river or stream and those portions of the floodplain adjoining the channel which are reasonably required to carry and discharge a 100-year flood)	Occupying, filling, or grading lands in a floodplain, streambed, or channel of a stream	Water Resources Commission Act Part 13 – Floodplains and Floodways	Act 245, Public Acts of 1929 R323.1313	Yes
	Provides for the conservation, management, enhancement and protection of fish, plant life, and wildlife species endangered or threatened with extinction.	Endangered Species Act	MI Act 203	No
	TAhis act creates and regulates wilderness, wild, and natural areas.	Wilderness and Natural Areas Act	MI Act 241	No
Listed Site	Listed site of environmental contamination.	Environmental Response Act	MI Act 307	Yes

684031tab6-4

AUTO ION SITE
KALAMAZOO, MICHIGAN

TABLE 2-5

POTENTIAL MICHIGAN ACTION SPECIFIC ARARS

REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
Controls MI air pollution by regulating an air pollution control commission within the state health department and other certain county agencies.	Air Pollution Act	MI Act 348	Yes
Indicates remedial preferences at sites of environmental contamination.	Environmental Response Act	MI Act 307	Yes
Protects public health and the natural resources of the state by licensing and regulating persons engaged in generating, transporting, treating, storing, and disposing of hazardous waste. It also provides a plan for the safe management and disposal of hazardous waste by establishing a list of criteria for hazardous waste which requires treatment, storage, or disposal at an approved facility.	Hazardous Waste Management Act	MI Act 64	Yes
Regulates inland lakes and streams and protects riparian rights and the public trust in inland lakes and streams.	Inland Lakes and Streams Act	MI Act 346	No

TABLE 2-5 Continued...

REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
Enforces persons engaged in removing liquid industrial wastes from the premises of other persons to be licensed and bonded. It also provides for the control of the disposal of wastes.	Liquid Industrial Control Act	MI Act 136	No
This act regulates working conditions including the duties of employers and employees as to places and conditions of employment.	Michigan Occupation Health and Safety Act	MI Act 154	Yes
Provides control of drilling, operating, and abandoning of mineral wells to prevent surface and underground waste. It also enforces the inspection, repairing, and plugging of mineral wells and for entering on private property for that purpose	Mineral Well Act	MI Act 315	No

TABLE 2-5 Continued...

REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
Authorizes the establishment of a system of designated wild, scenic and recreational rivers. It also authorizes the protection of designated river frontage by acquisition, lease, easement or other means. This act has the ability to enforce limitations on uses of land and their natural resources.	Natural River Act	MI Act 231	No
This act protects public health and controls public water supplies. It also issues specifications and construction permits for waterworks systems.	Safe Drinking Water Act	MI Act 399	No
This act provides for the control of soil erosion and protects the water from sedimentation. It also describes the powers, duties and functions of the state and local agencies.	Soil Erosion and Sedimentation Control Act	MI Act 347	Yes

TABLE 2-5 Continued...

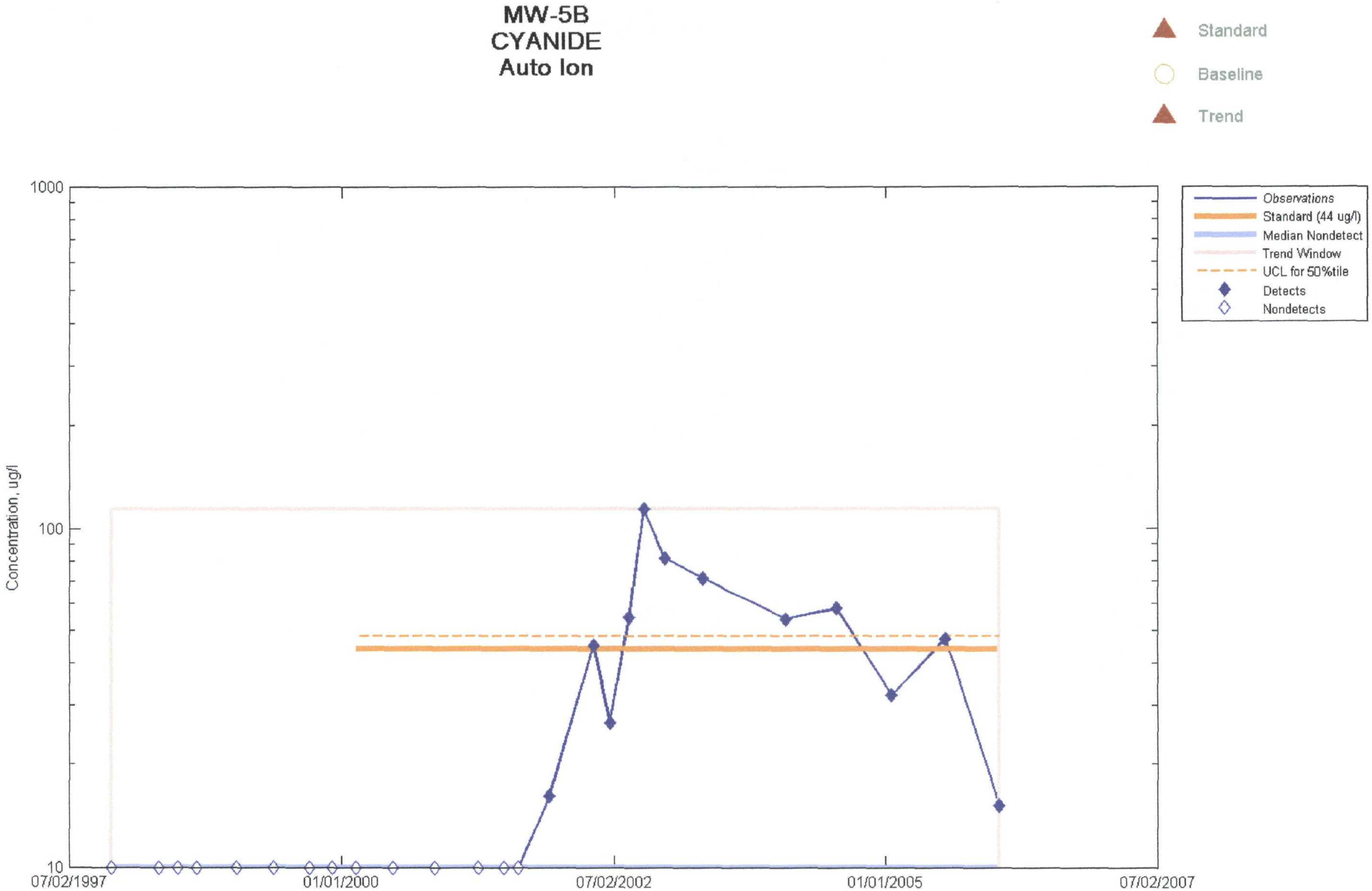
REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
This act creates the regulations and management of solid wastes as well as describing the powers and duties of certain state and local agencies and officials.	Solid Waste Management Act	MI Act 641	Yes
This act provides protection and management of shorelands and the zoning ordinances.	Shoreland Protection and Management Act	MI Act 245	No
This act creates a Water Resources Commission to protect and conserve the water resources of the state, to have control over the pollution of any waters in the state and the Great Lakes, to have control over the alteration of the watercourses and the flood plains of all rivers and streams, with powers to make rules governing the same. It also requires permits to regulate the discharge or storage of any substance which may affect the quality of the waters.	Water Resources Commission Act	MI Act 245	Yes

TABLE 2-5 Continued...

REGULATED ACTIVITY	REGULATION	CITATION	POTENTIAL ARAR?
This act provides specifications and issues construction permits of sewerage systems.	Water and Sewerage Act	MI Act 98	No
Any facility which processes, uses, stores, transports, or conveys bulk materials;	Establishment of fugitive dust control programs	Act 348, PA of 1965 R336.1371	Yes

68403\tbl2-5

ATTACHMENT 22

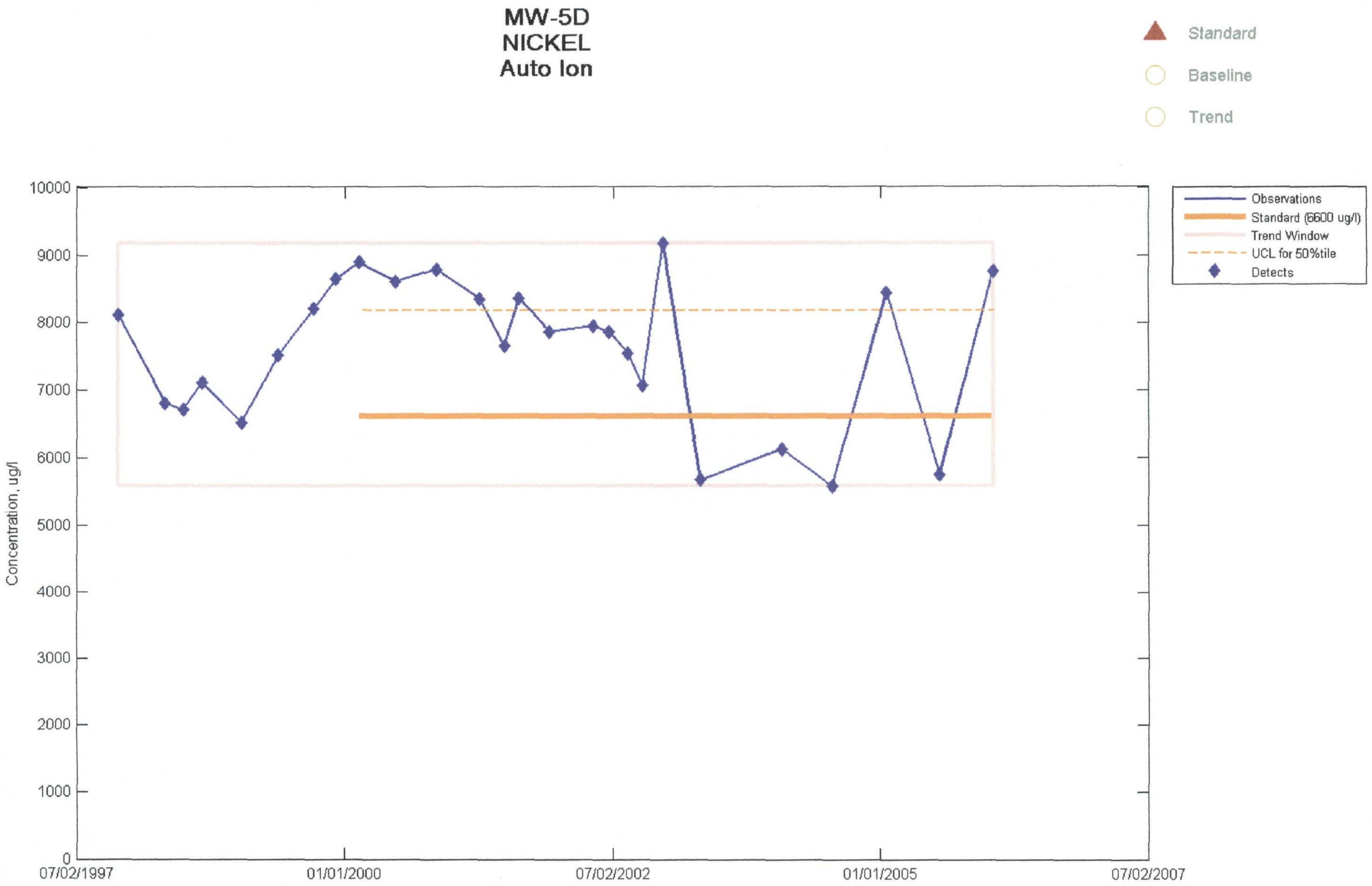


Standard Test (95%): Exceedance <UCL = 4.82e+001 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): Upward <Slope = 5.42e+000 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

Attachment 22: Exceedences of Site-Specific GSI Values (page 1 of 2)
Auto Ion Five-Year Review
September 2006



Standard Test (95%): Exceedance <UCL = 8.17e+003 ug/l>
Baseline Test (%): No Change <UPL/LPL = -/- ug/l>
Trend Test (90%): No Trend <Slope = -5.97e+001 ug/l/year>

Statistical Note: ND surrogate = 0.5 X Median of nondetects' PQLs

Run Date: 13-Jun-2006
Prepared by: USEPA

Attachment 22: Exceedences of Site-Specific GSI Values (page 2 of 2)

Auto Ion Five-Year Review
September 2006